36390 Intake
R4-FL-Seminol

SEMINOLE
ELECTRIC
COOPERATIVE
INCORPORATED

January 9, 1980

Dr. Lee Tebo, Director
Enforcement Division
U. S. Environmental Protection Agency
Region IV
Athens, Georgia

Re: Seminole Plant Units #1 and #2
Application No. FL0036498

Dear Dr. Tebo:

We herewith submit to you a document entitled "Seminole Plant Units No. 1 and No. 2 316(b) Study and Report". This document, together with the Final Environmental Impact Statement and the Environmental Analysis dated August 4, 1978 and revised March 15, 1979, contain all of the information necessary for a determination to be made under Section 316(b) of the Clean Water Act "that the location, design, construction, and capacity of the cooling water intake structure reflects the best technology available for minimizing adverse environmental impact".

The Study and Report include documentation of extensive in-situ testing of a model of the proposed intake operated at the site and an evaluation of potential adverse environmental impacts. On the basis of these studies, including actual observed operating performance of a test apparatus at the proposed intake site in the St. Johns River, 2 mm slot-opening wedge-wire screens were chosen for the make-up water intake. It was found that screens of this size opening exhibited lower approach velocities over time and, during intensive studies, entrained numerically smaller numbers of fish. This design is superior to all other intake technologies now available.

Based on the information contained in the documents referred to in the first paragraph, we request:

1. That the location, design, construction, and capacity of the cooling water intake structure be determined to reflect the best technology available for minimizing adverse environmental inpact, and

2. That the provisions of Part 1B 1 e of the NPDES Permit, which would require 316(b) monitoring, be waived, and

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SEMINOLE PLANT UNITS NO. 1 AND NO. 2
316b STUDY AND REPORT

PREPARED FOR:
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NOVEMBER 1979

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1.0 EXECUTIVE SUMMARY

This report presents the results of studies conducted for Seminole Electric Cooperative, Inc. with regards to the proposed cooling water intake structure of Seminole Plant Units No. 1 and No. 2 which will use makeup water from the St. Johns River in Palatka, Florida.

The studies reported herein are an extension of the environmental work reported in "Site Certification Application and Environmental Analysis, Seminole Plant Units No. 1 and No. 2" dated August 4, 1978 and revised March 15, 1979, hereinafter referred to as the "EA." These studies, together with those in the EA were performed under Section 316(b) of the Clean Water Act, or CWA (P.L. 92-500 as amended in 1977) and criteria of the USEPA 316(b) Guidance Manual (1977). Section 316(b) of the CWA requires that the "...location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

A Plan of Study for the work to assist USEPA to determine best technology available (BTA) was submitted to and approved by the USEPA (Region IV), the U.S. Fish and Wildlife Service, or USFWS (Region IV), the USFWS National Power Plant Team, the Florida Department of Environmental Regulation, and the Florida Game and Freshwater Fish Commission.

A principal part of these studies consisted of extensive testing and analyses of impingement and entrainment of vulnerable fish and macroinvertebrates by the use of a test intake apparatus operated in the St. Johns River at the proposed intake site. The abundance and distribution of fish and macroinvertebrates at the site were also studied. Reviews were conducted of historical fishery data, fish life history data, physical data on the river, and operating characteristics of the proposed plant.

With respect to the criteria of Section 316(b) of the CWA (as enumerated above), the following conclusions were reached:

1. The location of the plant intake is offshore in an area of relatively low fish and ichthyoplankton densities. This location avoids beds of aquatic macrophytes and fish nursery areas.

2. The design of the intake incorporates screens with fine openings that have a low approach velocity (less than 0.5 feet per second, maximum) and an extremely uniform velocity distribution. These screens greatly reduce impingement and entrainment of younger fish life stages and prevent impingement and entrainment of older fish by excluding them.

3. Dredging and construction impacts will be greatly reduced by the presence of relatively deep water at the offshore location and by the absence of productive macrophyte beds and associated communities.

4. Closed-cycle cooling will greatly reduce the capacity (cooling water withdrawal rate) for the proposed units.

Furthermore, in regards to the USEPA (1977) criteria:

5. Losses due to impingement or entrainment will be small. Only a very small fraction of the river will be affected.

6. The operation of the intake will not significantly reduce or impair the ecological functioning of the community.

7. Yields of sport or commercial fish will not be significantly reduced.

8. Endangered species will not be adversely affected.

Therefore the cooling water intake structure of proposed Seminole Plant Units No. 1 and No. 2 will meet Section 316(b) criteria for "...the best technology available for minimizing environmental impact."

POS was only finalized after a number of regulatory agencies including USEPA, U.S. Fish and Wildlife Service, Florida Department of Environmental Regulation, Florida Game and Freshwater Fish Commission, the St. Johns Water Management District, and others had opportunities to comment on it.

The POS as finalized had three principal objectives:

1. Assess the potential for adverse impact of operating the proposed intake.
2. Assess mitigation of the aquatic impacts caused by the intake by utilizing two different screen sizes and comparing them.
3. Determine if the two slot sizes of screens tested are feasible for use in the St. Johns River, based on debris and biofouling tests.

Two screen openings or slot sizes (1 and 2 mm) were considered to be in the range of screen opening sizes necessary to exclude the early life stages and smaller sizes of fish species known to be in the plant site area. They were also large enough to operate reliably at the site. However, the differential screening ability and operational feasibility associated with these two slot sizes and the backwash system proposed to clean the screens were not known. Consequently, Seminole conducted an in-situ intake testing program prior to selection of the final screen design.

The purpose of this report is to discuss the potential adverse environmental impacts of the operation of the proposed intake structure and the design technology chosen to mitigate these impacts.

2.2 IMPACTS ADDRESSED

Potential adverse environmental impacts due to intake construction are discussed in "Site Certification Application and Environmental Analysis (EA) - Seminole Plant Units No. 1 and No. 2" dated August 4, 1978 and updated March 15, 1979. These impacts fall into two categories: impingement impacts and entrainment impacts.

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2.2.1 Impingement

Impingement is defined as the entrapment of organisms against a screening device. Organisms impinged are held against the screening device by the force of the water being drawn through the screens. Impingement is generally associated with larger organisms that can be retained on the screening device without being drawn through the screens. Injury to organisms results from physical damage, abrasion, and suffocation (through gill covers on fish being held shut).

Where traveling screen systems are used, fish are often lifted from the water and then fall back into the intake area. Consequently, they may be impinged several times. These systems also may dry fish, and high pressure screen washes may abrade and damage the fish further. Conventional traveling screen systems also may have no provision for returning fish to the water body. Conventional traveling screens are typical of most all present cooling water intakes.

Generally, USEPA (1976) recommends an average intake approach velocity of 0.5 feet per second (fps). This is generally measured about 1 foot (ft) in front of the screening device. Velocities through screens are higher due to the smaller cross-sectional area in the screen and the fact that the same flow passes through the screen as approaches it ($Q = VA$, where: Q = flow, V = velocity, A = cross-sectional area). USEPA (1976) also recommends that the velocity field through the screen be as uniform as possible to avoid areas of higher velocity flow on the screen surface which can increase impingement. Conventional traveling screen systems have highly irregular velocity fields (USEPA, 1976).

2.2.2 Entrainment

Entrainment is the passage of organisms through an intake screening system into the cooling water system. Entrained organisms generally suffer very high to total mortality. Smaller organisms and life stages with limited swimming ability are generally most subject to entrainment. Phytoplankton and zooplankton are entrained in cooling systems, but their loss is generally of low importance because of their high abundance and relatively rapid reproductive cycle. Of greater concern are those organisms with longer reproductive cycles and more delicate life stages, especially fish.

In conventional intake systems, screens allow passage of fish eggs, larvae, juveniles and the adults of small species. In the St. Johns River, almost all fish present have eggs, larvae, and juveniles of a size that could be entrained through such systems. In addition, adults of the various goby species, bay anchovy, silversides, and other fishes are potentially entrainable through conventional screens.

There are only two means of reducing the number of organisms entrained by conventional intake systems: (1) locating the intake in an area where the numbers of organisms available for entrainment are lower (generally offshore, away from more productive nearshore areas); and (2) reducing intake water volume requirements. Both of these measures have been taken as discussed in the EA.

Until very recently, non-conventional technologies that could be used to reduce intake impacts were extremely limited, and some offered no significant mitigation of entrainment losses without increasing losses due to impingement to the same or even greater extent.

One relatively new technology has provided a major advance in intake impact mitigation. This is a stationary, fine opening, wedge-wire intake screen. This type of screen provides very uniform velocity fields at relatively low intake velocities. The screen's small openings prevent entrainment, while its low intake velocity and uniform velocity field reduce the occurrence of impingement of organisms against the screen. Because the screens are stationary, no abrasion, lifting, reimpingement, drying, or screen wash damage to organisms will occur. In addition, the volume of water influenced by the screens will be small, limiting the opportunity for fish-screen interactions. The small screen openings will prevent the entrainment of many smaller organisms and life stages. Use of such a system will therefore greatly reduce adverse impacts.

2.3 REPORT ORGANIZATION

In this report, a summary of the background of the project is followed by a description of the intake test program, a presentation of results, an analysis of the results, and conclusions. A BTA statement, references, and appendices complete the report.

3.0 BACKGROUND

3.1 PLANT LOCATION

The Seminole Units No. 1 and No. 2 will be constructed inland of the northwest bank of the lower reach of the St. Johns River (Figure 1) in northwest Putnam County, Florida. The lower reach of the St. Johns River extends 100 miles (161 km) from the Oklawaha River north to the Atlantic Ocean. The portion of the river adjacent to the site is about 6,000 feet (ft) or 1,800 meters (m) wide and has an average depth of about 10 ft (3.0 m). The river at this point is considered to be a freshwater estuary. The mean tidal range is 1.2 ft (0.4 m) at Palatka, Florida (USGS, 1977). The net mean daily freshwater runoff at Palatka was estimated at 7,613 cubic feet per second (cfs) or 215.58 cubic meters per second (m^3/sec). The net river velocity is approximately 0.2 foot per second (fps) or 0.06 meter per second (mps) with a maximum velocity on the order of 1.0 fps (0.30 mps).

Published records covering 8 years show that the maximum upstream river flow was 20,400 cfs (577.66 m^3/sec) on March 24, 1968 and that the maximum downstream river flow was 31,311 cfs (886.63 m^3/sec) on November 5, 1970. The 7-consecutive-day average daily minimum absolute flow (7-day MAF) of record (from September 2 to September 8, 1971) was 180 cfs (5.10 m^3/sec), with a net velocity of less than 0.004 fps (0.001 mps).

3.2 COOLING WATER SYSTEM

The cooling system for Seminole Plant Units No. 1 and No. 2 is described in the EA. The system will utilize natural-draft cooling towers and a closed-cycle cooling system.

Makeup water for the cooling system will be withdrawn from the St. Johns River through wedge-wire screens, then into a wetwell within the bulkhead (see Proposed Intake Structure) and through pipes to river water withdrawal pumps. Water will then pass through piping to the plant's circulating water system (see Figure 2).

The combined makeup water requirements for both units will necessitate a maximum withdrawal rate of 44 cfs (1.25 m^3/sec). This <u>maximum</u> plant water use is approximately one-half of one percent (0.005) of the mean river flow. The <u>mean</u> makeup water requirement will be 24.5 cfs (0.69 m^3/sec). The total makeup water requirement for both units will equal a maximum usage of $3.80x10^6$ cubic ft per day (ft^3/dy) (107,653 m^3/dy) and an average usage of $2.11x10^6$ ft^3/dy (59,851 m^3/dy). Under normal operations, the average water requirements are a combination of cooling tower evaporative losses, drift losses, blowdown, and service water requirements, as follows:

Makeup Water Required		Blowdown		Evaporative Losses		Losses	Service Water Requirements
$2.11x\ 10^6$*	=	$520x10^3$		$1.59x10^6$		$5.21x10^3$	361
59,851**	=	$14.73x10^3$		$45.02x10^3$		148.10	10.22

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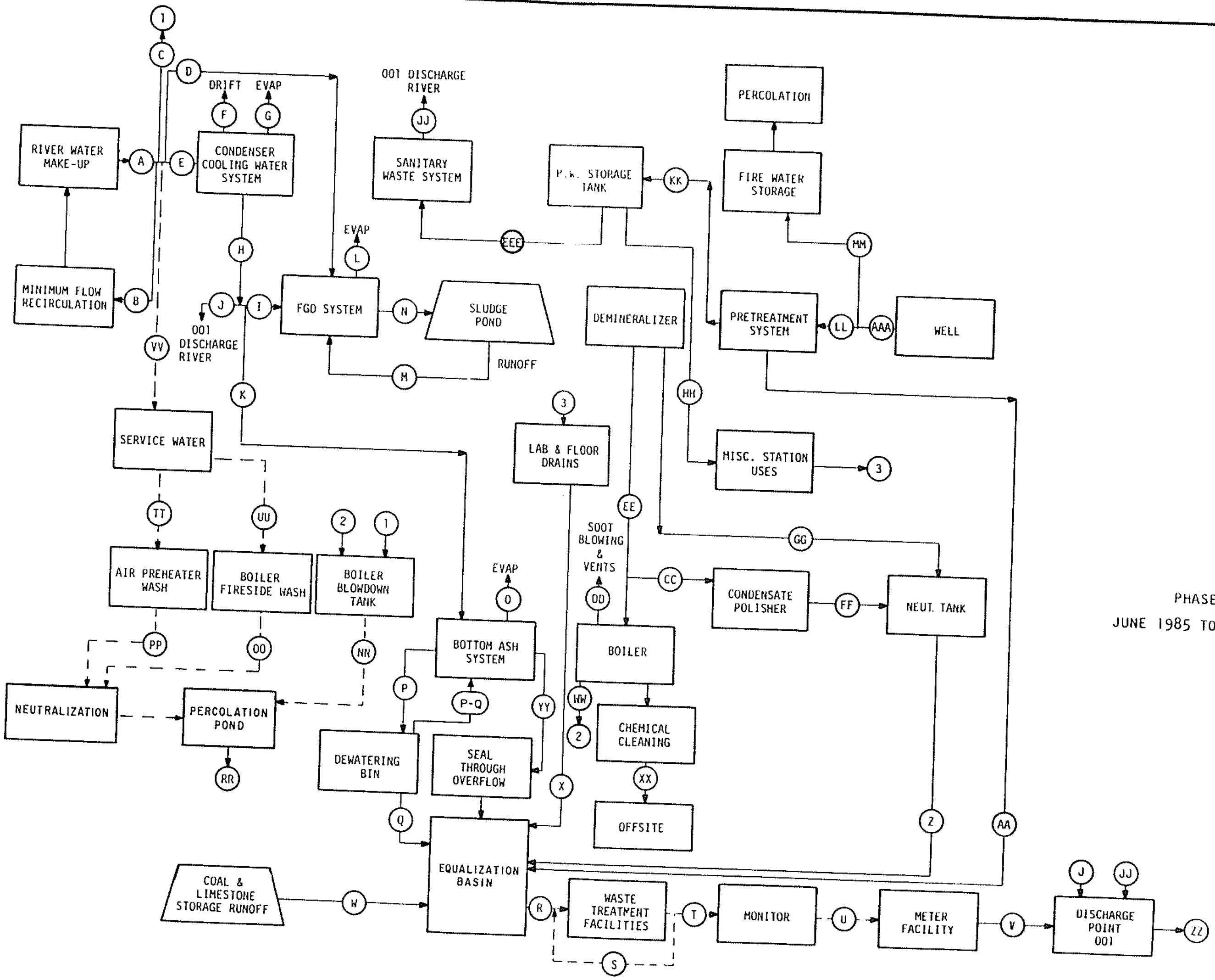
*All numbers across are ft^3/dy.

**All numbers across are m^3/dy.

A schematic of water flow throughout the plant is provided in Figure 2.

3.3 INTAKE ALTERNATIVES

The final design of the proposed intake structure was selected from five alternative intake types and structures that could feasibly be operated at the site. Among the criteria considered in the final selection were (1) the use of fine-opening screening in order to screen out, and hence reduce,



PHASE III
JUNE 1985 TO JUNE 2020

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FIGURE 2
SCHEMATIC OF WATER FLOW
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

the entrainment of younger and smaller fish life stages and adults of smaller species in the site area, and (2) maintenance of a low intake velocity (less than 0.5 fps) through the screen as recommended by USEPA (1976) to prevent retention and impingement of fish and larger invertebrates on the screens.

Wedge-wire (fine-opening) screens, although a relatively new technology for makeup water intake screenings, were considered for use on the Seminole intake because of their potential advantages in reducing impingement and entrainment impacts. Most studies of the use of wedge-wire screens for biological screening of intakes have been fairly recent and have been largely carried out by the Tennessee Valley Authority (TVA) (Heuer and Tomljanovich, 1978; Smith and Vigander, 1978; Smith, 1978; Heuer and Tomljanovich, 1979) and Delmarva Power and Light (Key and Miller, 1978; Hanson, et al., 1978a, 1978b).

Engineering studies have also been carried out (Cook, 1978). Other studies are presently ongoing. The studies conducted so far have shown that wedge-wire screens, when properly designed, installed, and operated, may be of substantial benefit in reducing impingement and entrainment impacts. Laboratory studies have shown substantial bypass of test screen intakes (Heuer and Tomljanovich, 1978; Hanson et al., 1978a, 1978b), and previous in-situ studies have generally shown lowered entrainment. Other intake types capable of substantially reducing entrainment and impingement impacts (such as the Ranney well) were not feasible because of site geological conditions.

The five alternatives evaluated by Seminole were the following:

1. Conventional intake with flush-mounted vertical traveling screens
2. Conventional vertical traveling screen intake with Surry-type modifications to the screens

3. Offshore perforated pipe or wedge-wire screen intake
4. Shoreline perforated pipe or wedge-wire screen intake
5. Offshore cylindrical wedge-wire bulkhead-mounted screen intake

These are described in Chapter 9 of the EA.

3.4 INTAKE DESIGN

3.4.1 Selected Intake Configuration

A fine-opening wedge-wire intake was selected for the reasons outlined in EA Chapter 9.0. Screen openings of 1 to 2 mm were considered to be the smallest opening sizes that could be potentially operated at the site with any degree of reliability. These screens offer the advantage of reducing interactions between the screens and fish and excluding organisms, thus decreasing the potential for adverse impacts. Screen units would be readily removable by using overhead hoists. The screens could then be carried to a cleaning deck for scrubbing (Figures 3, 4, and 5). Complete individual unit removal and in-place backwash could be provided by appropriate valving. This feature is an advantage in waters with fouling biological growth, such as the St. Johns River. The fine screens, along with an 0.5 fps approach velocity, would help minimize any potential adverse impacts.

After considering several design configurations, the design finally selected was the bulkhead (dock) mounted cylindrical wedge-wire screen intake located offshore with maintenance access to shore (Figure 3). This was selected as the proposed intake structure (Figures 4 and 5) after considering its location, ability to use a small screen opening size, relatively low capital costs, less need for dredging, mechanically simple design with few anticipated problems, and low impact to the vegetated nearshore zone. A detailed description of the proposed intake location and design features are contained in the following sections (3.4.2-3.4.4).

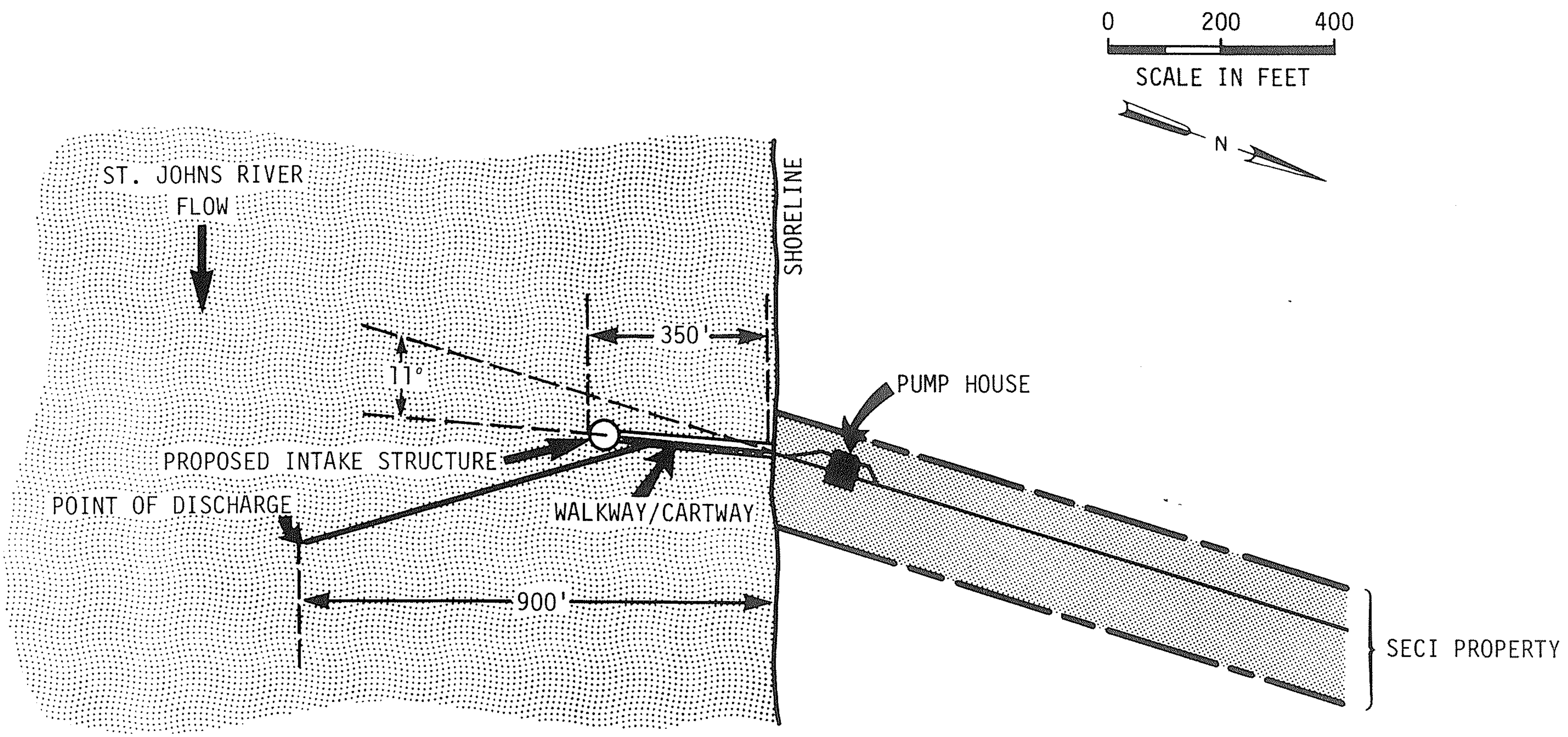


FIGURE 3
SITE PLAN
PROPOSED INTAKE STRUCTURE
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

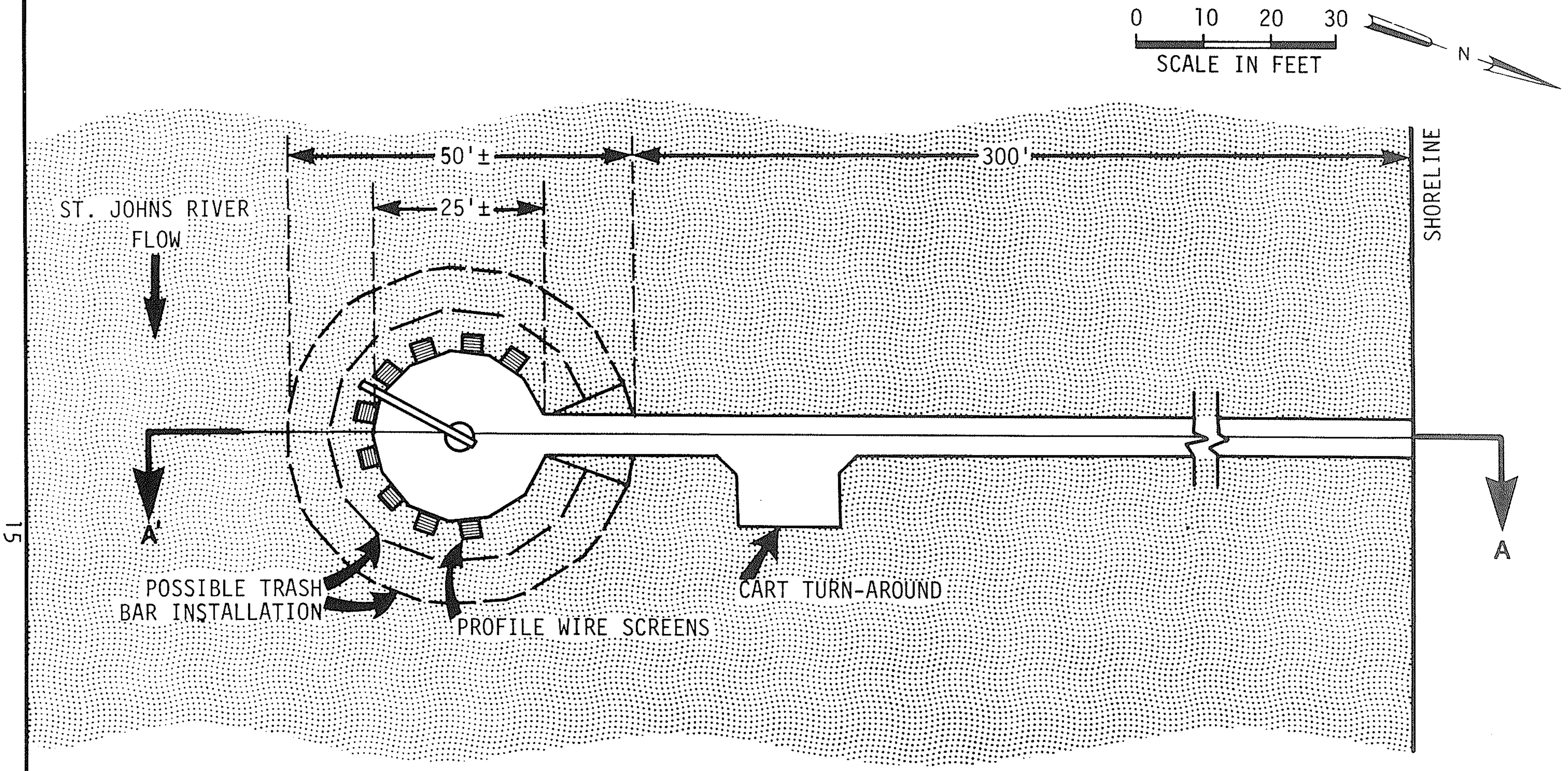
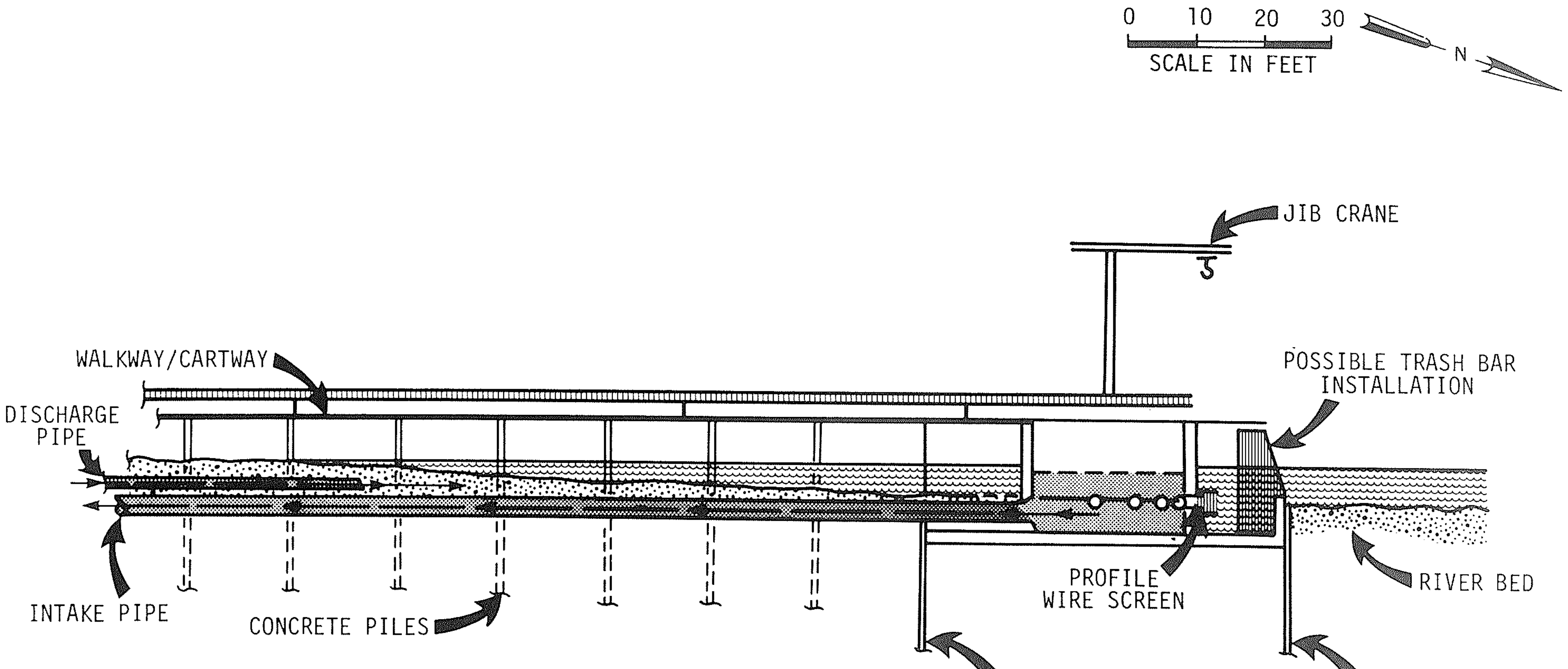


FIGURE 4
PLAN VIEW
PROPOSED INTAKE STRUCTURE
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.



SECTION A-A

FIGURE 5
SIDE VIEW
PROPOSED INTAKE STRUCTURE
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

3.4.2 Proposed Intake Location

The proposed plant intake structure is to be located approximately 6,561 ft (2,000 m) downstream of Rice Creek in Section 18, Township 9 South, Range 27 East (29° 42' 46" north latitude and 81° 38' 14" west longitude). The selected site is labeled as Corridor A in the EA (1979) and has been chosen over the other candidate corridors because it is the location most likely to reduce any potential adverse impacts.

A detailed study using a variety of techniques was performed during spring 1979 to determine the proper distance from shore to locate the proposed makeup water intake and plant discharge so as to lower the potential for adverse impacts. Among considerations evaluated were: (1) the identification of potential spawning or nursery habits; (2) the identification of areas of high fish concentration; and (3) identification of areas of high production. Techniques were utilized (as detailed in Appendix A) to sample as wide a range as possible of habitats and species present.

Of particular importance was the identification of potential nursery and spawning habitat. Vegetation beds, particularly those containing <u>Vallisneria americana</u> (eel grass) are considered to be good fish nursery habitat and are defined as such by Florida law. A vegetation survey conducted in the vicinity of the intake corridor confirmed the presence of such a vegetation bed from about 16.4 ft (5 m) to approximately 180 to 230 ft (55 to 70 m) offshore. This vegetation forms a fairly continuous band along the shoreline both upstream and downstream. Data from extensive fish studies showed that this area is utilized by a variety of small forage fish. Particularly abundant were the rainwater killifish (<u>Lucania parva</u>), mosquitofish (<u>Gambusia affinis</u>), sailfin molly (<u>Poecilia latipinna</u>), tidewater silverside (<u>Menidia beryllina</u>), and naked goby (<u>Gobiosoma bosci</u>).

These species were greatly reduced in abundance beyond the macrophyte bed. Many of the fish species found in this area of the river have demersal or adhesive eggs, which are usually found attached to vegetation. Many others, particularly game and pan fishes (sunfishes and basses), nest inshore in shallow weedy areas. Eggs and larvae of these species also remained inshore. Individuals of Lepomis macrochirus have been observed to nest in the vicinity of the test dock.

Numbers of certain benthic macroinvertebrates tended to be higher offshore of the weed bed in areas where the bottom is littered with organic detritus. These were primarily tubificid worms and midges (chironomids). Macroinvertebrate drift organisms tended to decrease in abundance with distance from shore, and none were rare or of exceptional importance. Most taxa were very widespread with fairly high abundances. Larger macroinvertebrates, including the blue crab (Callinectes sapidus) and some shrimp species, were more commonly observed in the weed bed area.

The offshore area outside the weed bed is apparently utilized by larger fish and older life stages. Particularly abundant were juveniles and adults of the Atlantic croaker (Micropogon undulatus) and adult white catfish (Ictalurus catus). Also abundant at other times were adults and juveniles of the bay anchovy (Anchoa mitchilli). None of these three species would be vulnerable to entrainment or impingement by the proposed wedge-wire screen intake.

It was therefore decided to site the proposed intake 325 ft (99.1 m) offshore (Figure 3), beyond the vegetation bed. At this location, the intake will be well beyond the areas utilized by small forage fish and as nursery areas; it will also be inshore of the areas of higher abundances of the larger offshore species. This intake location will therefore reduce the potential for adverse impacts.

3.4.3 Proposed Physical Layout

The proposed intake will consist of a polygonal structure (bulkhead) at the riverward end of a newly constructed "dock" (Figures 4 and 5). The sides of the polygonal intake structure will function as a bulkhead for mounting of the intake screens. There will be nine cylindrical wedge-wire screens mounted on the sides of the bulkhead. The bulkhead structure will be located approximately 325 ft (99.1 m) offshore.

Water will be withdrawn through the screens into a wetwell contained within the structure and then through a 36 in. (0.91 meter) diameter intake pipe buried under the dock (Figure 5) to a pump house located upland on the Seminole property. The intake will be entrenched and will be backfilled with clean fill.

A concrete dock 6 ft (1.83 m) wide with a walkway will be constructed in the St. Johns River and will lead to the intake structure (bulkhead) offshore. It will be supported by concrete pilings (Figure 5). The dock will allow access to the intake by both maintenance personnel and a maintenance cart (cart turnaround shown on Figure 3). The dock will enable workers to work on the intake during its operation. A jib crane will be installed on the dock for lifting the individual screen cylinders out of the water for cleaning. Approximately 300 ft^2 (27.87 m^2) of stone riprap will be placed along the shoreline at its intersection with the dock to stabilize the shore in that area.

3.4.4 Proposed Intake Construction

The first steps in the construction of the intake will be the installation of a circular cofferdam made of sheet piling, which will surround the site of the polygonal bulkhead at the riverward end of the intake dock. When the cofferdam is installed, about 650 yds^3 (500 m^3) of material will be removed from within the enclosed area. The actual intake within the cofferdam will be constructed of steel or concrete. A trough will be left around the intake structure inside the cofferdam so that water will always be available for withdrawal by the intake into the system during operation (Figure 5). All dredge spoil will be disposed of upland in diked areas.

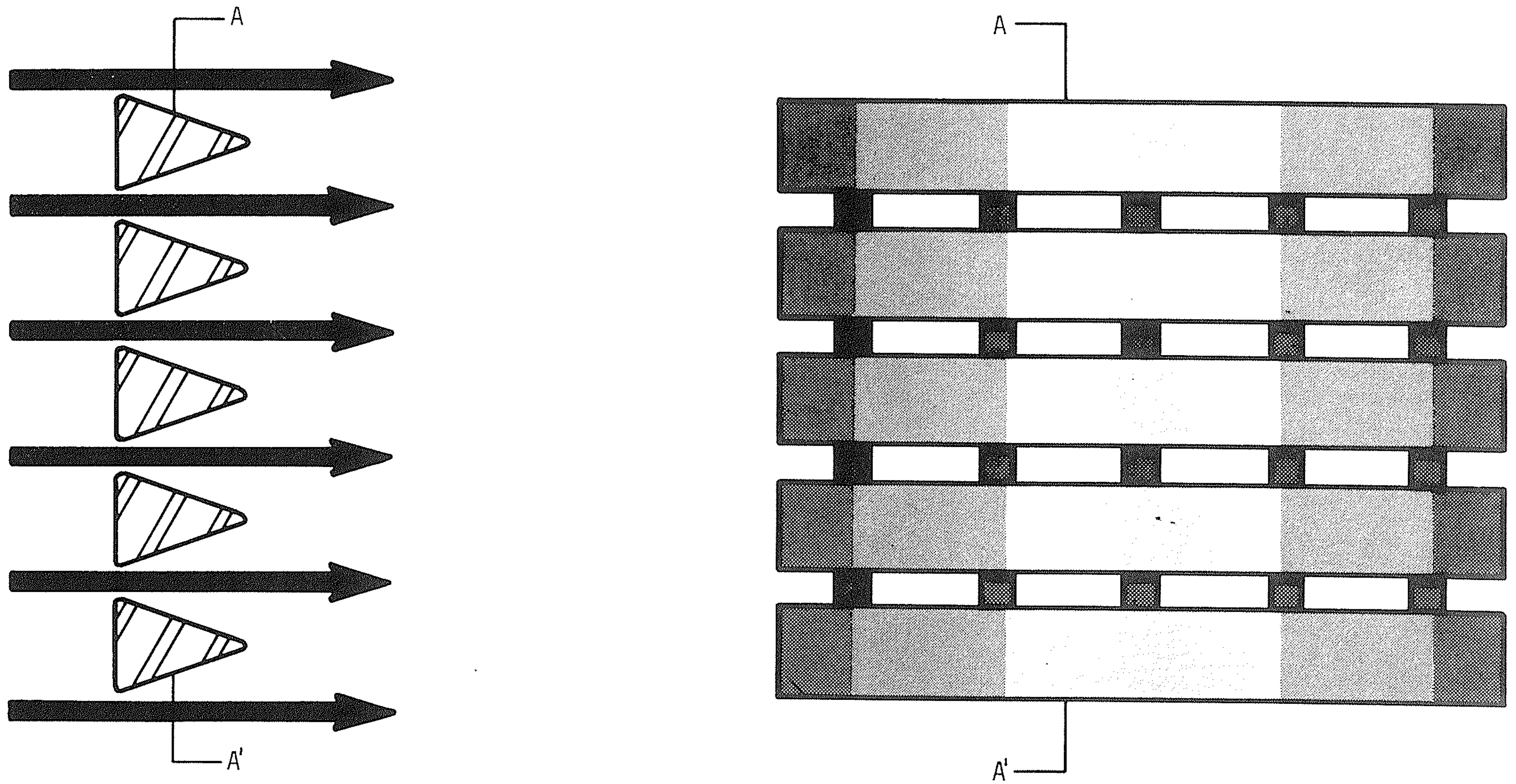
3.4.5 Wedge-Wire Screen System

To protect aquatic life, the structure will be equipped with a system of nine cylindrical, fine opening, wedge-wire screens (Figure 4). In addition to the nine screens operating, there will be three spares. This will allow some additional margin in cleaning operations so that screen velocities do not have to be significantly increased during cleaning.

Wedge-wire screens have V- or wedge-shaped slots (see Figure 6) formed by the wires. The size of the slot openings for the proposed intake will be either 1 or 2 millimeters (mm). The selected slot size will be the smaller practicable opening size that will not cause excessive fouling. The screens themselves will be made of stainless steel or a copper-nickel alloy.

The open area of the screen, which constitutes up to 51.6 percent of the screen area, keeps the approach velocity level very low while maintaining a very high intake capacity. The Seminole Plant Units No. 1 and No. 2 intake screens will be designed to maintain a maximum approach velocity of less than 0.5 fps through clean screens; to accomplish this, the screens will be designed to achieve the maximum expected inflow at slot (net) velocity of less than 0.5 fps through clean screens. During normal operations, approach velocities will be considerably lower.

Because of the low volume of each intake screen and because of the low approach velocity, only a small area will be influenced by the intake, and



SECTION VIEW

FRONT VIEW

FIGURE 6
FRONT AND SECTION VIEWS OF
CYLINDRICAL WEDGE-WIRE SCREEN
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

therefore few organisms will interact with it. The water velocity prior to entering the slots also decreases with increasing distances from the screens. Consequently, impingement and entrapment of organisms will be reduced because many organisms that could potentially become entrapped will be allowed to escape and survive (EPA, 1976). Entrainment potential will also be decreased by the same mechanism.

The cylindrical shape of each screen enhances its resistance to screen plugging because of its minimal resistance to the natural flow of the river. The screen design enables particles or materials that could plug the screens to flow around, and not against, the screens, thereby minimizing the accumulation of deposits on the screen face (U.O.P., Inc., 1977). Plugging of the screens is also minimized by the shape of the slots. Waterborne particles make only a 2-point contact with the screens at the outside of the screen face (Figure 6) causing particles smaller than the slot size to be passed through the system and particles larger than the slot size to be washed away (U.O.P., Inc., 1977). The majority of plugging should therefore occur only at the screen surface.

At any time when fouling reduces the screen opening area and subsequently induces system head losses, the screens will be cleaned. It is expected that screen units may be air cleaned ("burped") in-situ by attaching a flexible air line to the unit or by use of an embedded air-backwash pipe situated at the centerline of each screen unit. The line or pipe will force compressed air through the unit in reverse of normal water flow. The frequency of mechanical removal of the screen followed by brush cleaning will be reduced by performing this procedure. The wedge-shaped configuration will enable a more effective backwash cleaning of the screens' surface by acting as a nozzle to increase the effect of the backwash.

Trash bars to prevent the accumulation of large debris against the screens (Figure 5) may be installed as part of the proposed intake structure to ease screen maintenance.

4.0 INTAKE TESTING PROGRAM

A program to test the actual extent of potential adverse intake-related impacts was developed. This program was also designed to evaluate the potential of the selected screen slot sizes to mitigate adverse impacts, as well as the long-term performance (i.e., reliability) of the different slot sizes under existing site conditions.

4.1 LOCATION

An in-situ intake screen testing facility was designed to accurately simulate the proposed intake both physically and functionally. The testing facility was constructed on an existing dock about 490 ft (150 m) from the proposed intake (Figure 7).

4.2 APPARATUS

As the first step in test facility construction, test assemblies were installed on the end of the dock with a bulkhead (Figure 7). Two duplicate test assemblies containing cylindrical wedge-wire screens were mounted off the end of the dock in the St. Johns River.

For each assembly, water from the river was withdrawn through the cylindrical wedge-wire screens and then transported through a 3 in. (0.08 m) diameter PVC pipe and 3 in. Ever-Tite quick coupling (Figure 8) into a 3 in. semi-open impeller trash pump (Hydromatic Pump-model 30 MPD). The water was discharged through a 3 in. diameter PVC pipe. A gate valve to control flow and a flow meter to monitor pump discharge (Figure 9) were mounted in the discharge pipe. The water outflow was discharged through a 6 in. (0.15 m) diameter PVC expander pipe into a 35 in. (0.89 m) diameter collection tank. In the collection tank, a 363-micron (μ) mesh plankton net was suspended in the water, and two overflow outlets were provided to enable all of the water (and thus organisms) from the pump to be filtered through the net. The 1

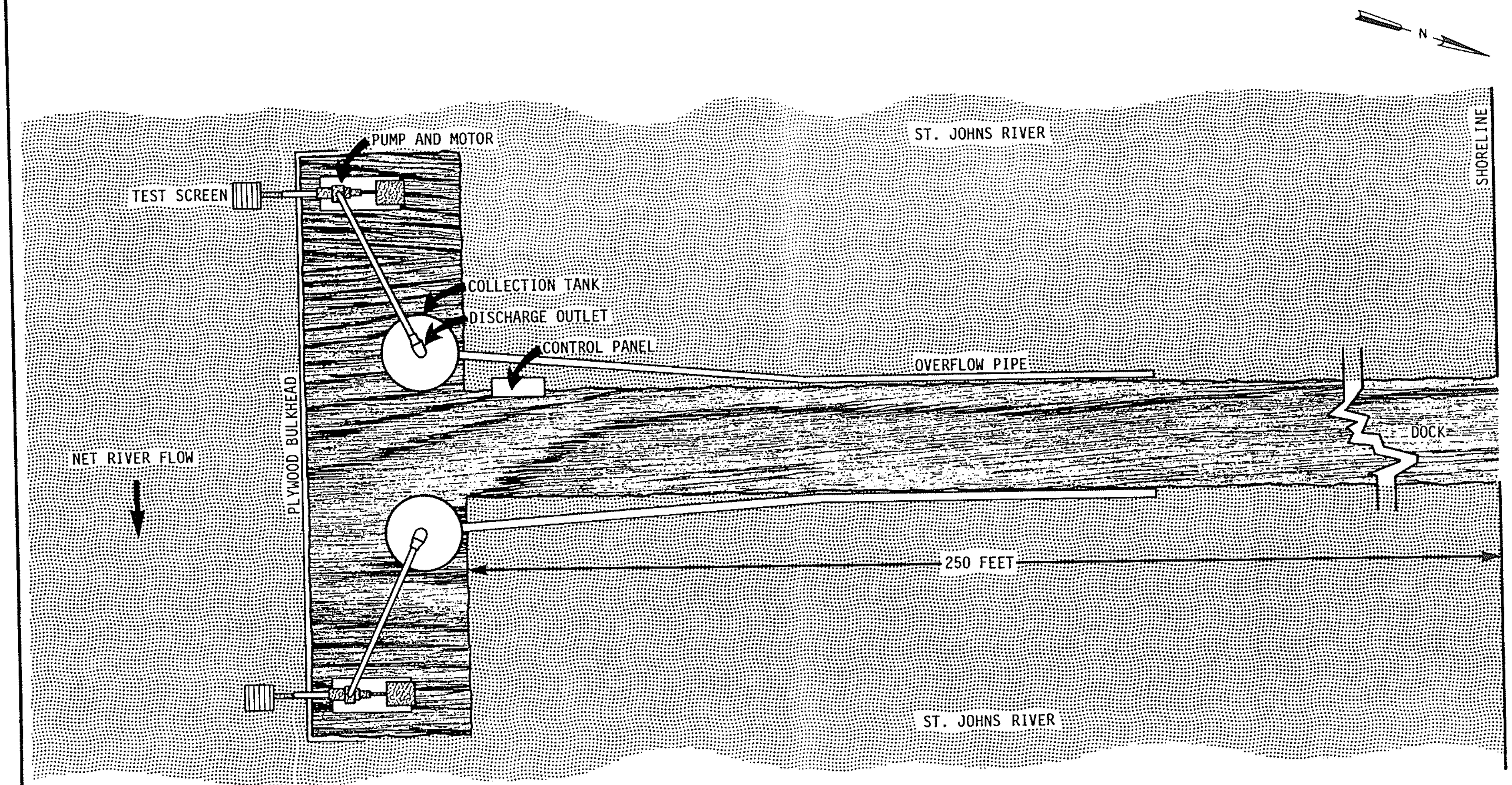


FIGURE 7
PLAN VIEW
STATIONARY SCREEN TEST APPARATUS
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

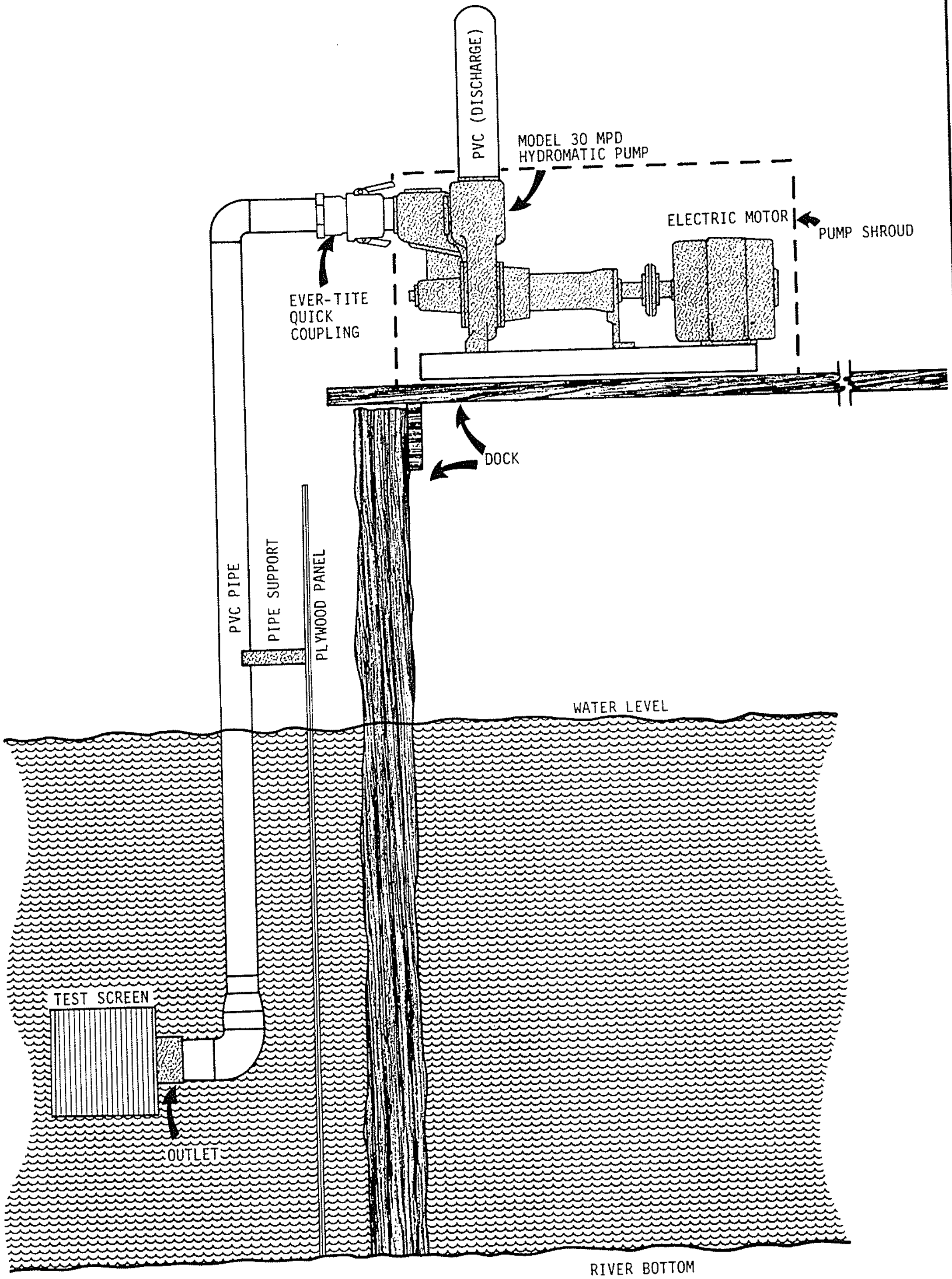


FIGURE 8
SIDE VIEW
STATIONARY SCREEN TEST APPARATUS
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

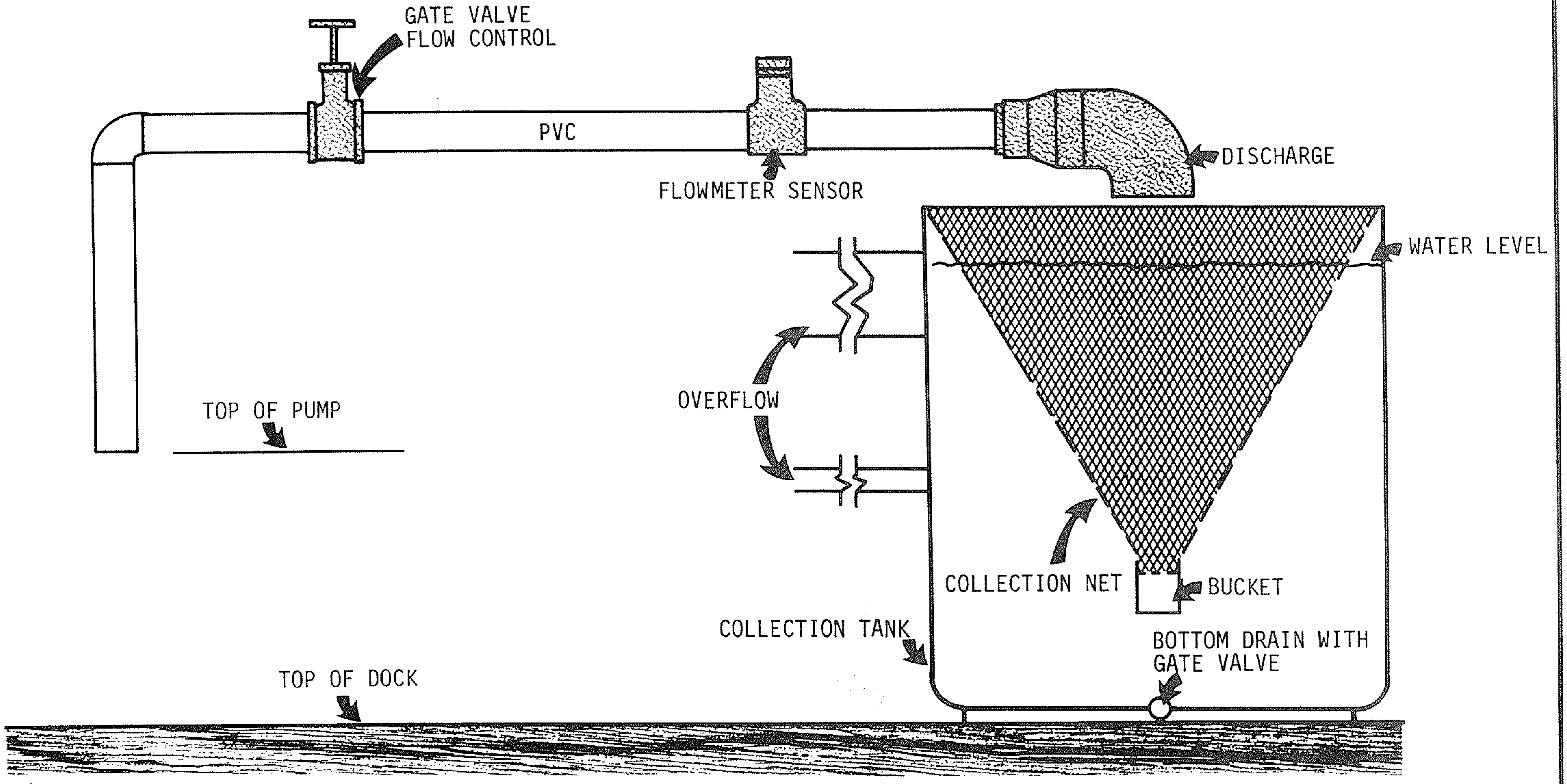


FIGURE 9
PUMP DISCHARGE AND ENTRAINMENT COLLECTION POINT
STATIONARY SCREEN TEST APPARATUS
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

in. (0.03 m) and 6 in. (0.15 m) diameter overflow pipes that discharged water from the intake structure extended 30 ft (9.14 m) from the collection tank toward the shoreline.

4.2.1 Dock/Bulkhead

The existing dock that was utilized for testing was constructed of untreated wood and extended approximately 250 ft (76.2 m) into the St. Johns River (Figure 7) at about the same depth contour as the proposed intake (Figure 10). It was used to provide access to the test apparatus, as will the proposed intake's walkway/cartway.

Plywood bulkhead panels were attached to the dock to simulate the bulkhead mounting of the screens on the proposed intake structure. The bulkhead not only helped to increase the similarity between the test apparatus and the proposed intake; it also prevented both circulation of previously filtered water into the screens and the possible biasing of test results by fish concentrating under the dock.

4.2.2 1 and 2 mm Wedge-Wire Screens

Two 12 in. (0.30 m) diameter Johnson cylindrical wedge-wire screens (Figure 8) were mounted on PVC pipe that extended over the dock and into the river. The screens were held about 18 in. (0.46 m) above the river bottom. These screens are prototypes of the larger versions proposed for the plant intake.

The average through-slot velocity of the 1 mm slot screen was designed to be 0.411 fps (0.13 mps) at a total design flow of 225 gpm (0.85 m^3/min). The 2 mm slot screen had an average through-slot velocity of 0.395 fps (0.12 mps) and the same total design flow. The maximum-through slot velocity for both screens was approximately 0.55 (0.17 mps) fps on about 15 percent of the screen surface. The screens were scaled so that, for both

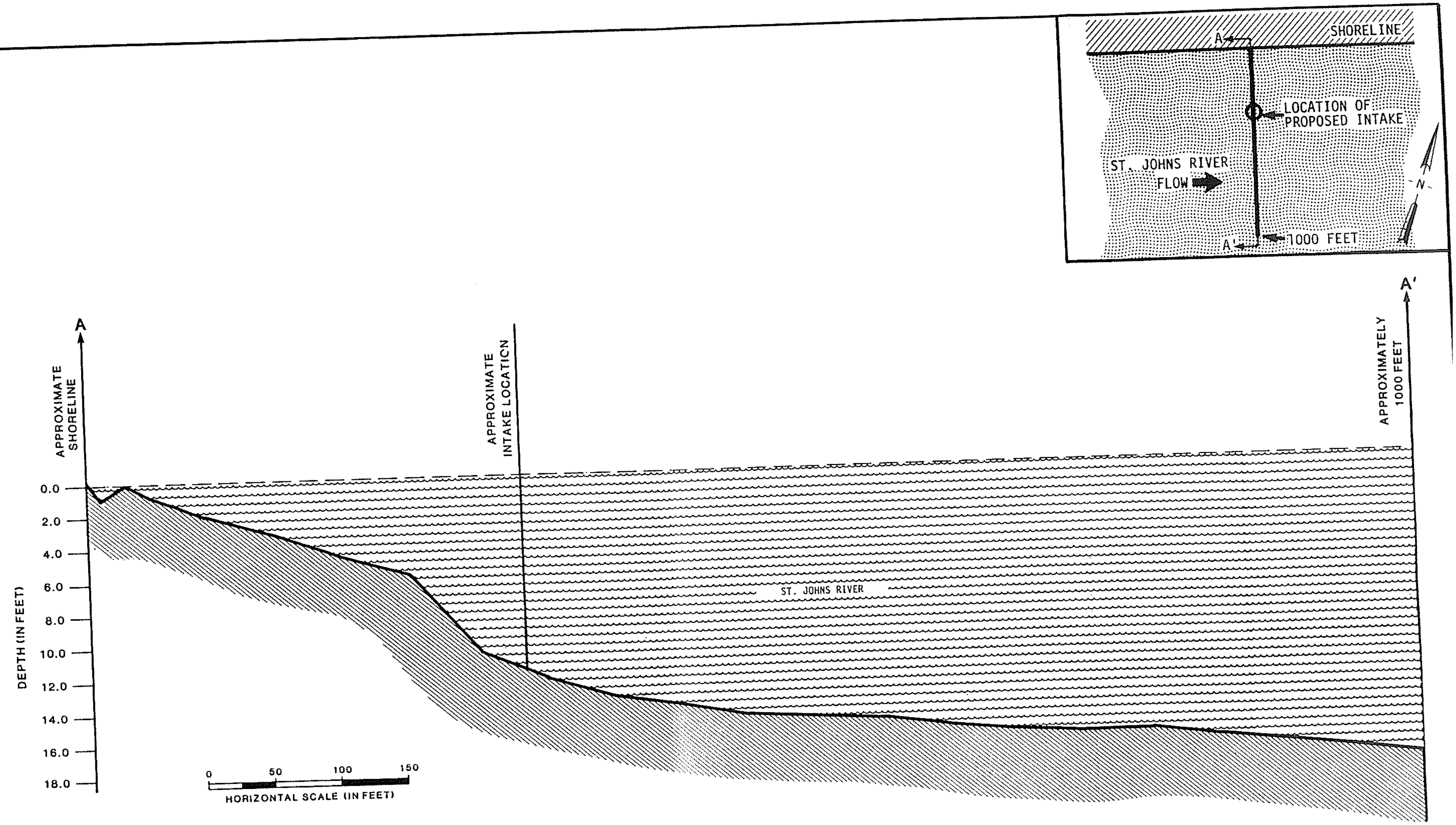


FIGURE 10
BOTTOM TOPOGRAPHY ALONG INTAKE LOCATION
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

slot sizes tested, the intake velocity and volume were approximately the same. This scaling allowed the test screens to be exchanged between the two pumping positions. The exchange provided statistical control for any bias due to screen/ pump position in relationship to the river, river flow, dock, or time of day. (See following section on Methodology.) Determination of the actual positions of the test screens was made by the use of a random number table and in accordance with a modified balanced block design (see Methodology section).

4.2.3 9.5 mm Wedge-Wire Screen

A wedge-wire test screen of 9.5 mm (3/8 in.) was also used in addition to the 1 and 2 mm screens to compare the capture efficiency of an essentially unscreened intake with the results of the 1 and 2 mm screens, as well as with ichthyoplankton net tows simultaneously conducted in the river. Originally, it was believed necessary to conduct this controlled test with a 9.5 mm screen instead of an open pipe in order to protect the pump from damage by the intake of large objects. The 9.5 mm screen was not mounted for testing of that size screen and was not engineered for the same intake velocity (it had a much smaller intake velocity). It was originally believed, therefore, that the 9.5 mm screen would have had little exclusion effect on the intake of entrainable organisms.

The 9.5 mm screened intake results and net tow results were designed to provide statistical covariates for the results of the 1 mm and 2 mm entrainment sampling, to assess the differences in efficiency of mitigation between the two wedge-wire screens.

4.2.4 Test Screen Removal

As shown on Figure 7, the 1 mm and 2 mm test screens were mounted in one of two pump positions on the dock when in operation. The 1 mm and 2 mm screens obviously could not have operated in the same position at the same time. During the period of time that the 1 mm and 2 mm screens were in operation, the 9.5 mm screen was placed out of the way on the dock. When the 1 mm and 2 mm screens were not in operation, the 9.5 mm screen assembly was plugged onto one of the two pump positions.

The process of detaching the screens from the pumps entailed unsnapping the Ever-Tite quick coupling connections, which enabled the screen and 3 in. (0.08 m) PVC pipe up to the connector to come off in one piece for movement to another position or removal.

4.2.5 Test Pumps

At each of the two screen positions (Figure 7), one of two identical motor driven hydromatic pumps (trash pumps) was mounted (Figure 8). The 3 in. diameter line and semi-open impeller of the hydromatic pump pass objects up to 3 inches across with little or no damage, and were chosen for this reason.

Around the pump and pipes, shock absorbent equipment was installed to reduce vibration so as not to deter entrainable species from interacting with the screens. The minimal vibration also simulated the low noise level of the proposed plant intake.

Both pumps were operated from a single control panel (Figure 7) consisting of two flow meter readouts and two on and off switches, one for each pump.

Prior to the start of the biofouling testing program, a 3 in. (0.08 m) diameter flow cutoff switch (Figure 9) was installed for the purpose of shutting off the pumps if the flow should fall below 170 gpm or 0.64 m^3/min (a 25 percent loss of flow) due to screen plugging.

4.2.6 Collection Tank Assembly

The 40 in. high fiberglass collection tanks (Figure 9) were mounted on top of the dock near the pumps (Figure 7). At the bottom of the tanks, a 1 in. (0.08 m) diameter bottom drain with a 1 in. diameter gate valve was installed in order to let the water drain from the tanks. The water level in the tanks was maintained at approximately 4-8 in. (0.10-0.20 m) below the rim at a flow of 225 gpm (0.85 m^3/min).

A sensor for an analog flow meter was installed (Figure 9) away from the bends of the discharge pipe to provide accurate flow measurement in the 0-500 gpm (0-1.70 m^3/min) range.

The expander pipe passing water into the collection tank had a diameter of 6 in. (0.15 m) to reduce the water velocity prior to discharging into the net, thereby reducing potential net clogging, splashing, overflow of the water, and damage to organisms entering the net.

The collection net installed in the tank was immersed in water to minimize the damage to organisms entering the net, prevent clogging, and thereby ease the process of measurement and identification.

The two overflow pipes attached to the collection tank (Figure 9) had a diameter of 1 (0.08 m) and 6 in. (0.15 m). These pipes allowed net filtration of all water. They also discharged water at a distance of approximately 30 ft (9.14 m) from the collection tank; this design prevented recirculation of water back through the screens and kept water from spilling over the tank onto the dock.

4.3 METHODOLOGY

As previously discussed, the purpose of the testing program was to evaluate and compare the potential operation of the two selected intake screens (slot sizes of 1 and 2 mm). To accomplish this purpose, a sampling and intake testing program was designed to provide the following:

5. During each test block, dissolved oxygen, temperature, conductivity, salinity, and water velocity near the test platform were measured and recorded.

6. At the conclusion of each screen test and prior to pump shutdown, a 363 micron mesh net was fitted over each screen to prevent the loss of any macroinvertebrates or fish eggs, larvae, juveniles, or adults impinged on the screens. These samples were washed into separate sample jars and preserved with formalin. The screens were washed in such a manner that impinged organisms were directed into the collection net.

7. For all test and tow collections, ichthyoplankton samples were sorted, fish eggs counted, and fish larvae and juveniles identified to the lowest practicable taxon. Major macroinvertebrates in the entrainment collections were counted and identified by taxa and life stage.

4.3.3 Phase III

The operational feasibility/biofouling testing was conducted from June to September 1979, initially on a bi-weekly and then on a monthly basis (actually once every 3-weeks). Discussions with an expert in the area (H.L. Moody, personal communication) and previous tests (Hanson, et al., 1978b) indicated that June to September was the period of maximum biofouling. A program of day/night entrainment monitoring and ichthyoplankton sampling by towing program was conducted concurrently. A true "open pipe" intake test was conducted during each feasibility/biofouling test period. The open pipe test consisted of removing the 9.5 mm. screen from the intake pipe, drawing water through the pipe, and collecting entrained organisms using the same procedures used during the 1 and 2 mm screen tests. Operating parameters including flow, shutdowns, and physical data were monitored twice daily throughout this period. Organisms and detritus found on the screens during this period were collected by scraping and hand removal and preserved. These were later identified and analyzed. Other biofouling organisms found associated with the apparatus were also collected and analyzed.

5.0 RESULTS

Major emphasis in this section is placed upon the various fish taxa and life stages, because fish have longer life cycles, lower fecundities, cannot disperse and recolonize as readily, and are therefore more vulnerable to impacts than macroinvertebrates. In addition, the fish species are generally of greater recreational and commercial importance.

5.1 IMPINGEMENT

As discussed in Subsection 2.2 of the introduction, operational impacts of an intake generally fall into two categories: impingement and entrainment.

At most cooling water intakes, impingement is the impact of greatest concern since it affects older, larger fish. It is of particular importance to fish populations, since it is the impact that affects reproductive-age fish.

Impingement was studied as described in the Methodology section, using a specially designed net to capture any organisms impinged upon the test screens. A total of more than 104 impingement collections was made during the course of these studies. Collections represented between 30 and 90 minutes' sampling time each. The most intensive studies of impingement occurred during Phase II.

During all test periods, impingeable organisms (larger than either the 1 or 2 mm slot opening) were present in the water near the test screens, as evidenced by 9.5 mm (or open pipe) entrainments. Visual observations were also made of the screens while in operation. The results of collections showed that no fish eggs, larvae, juveniles, or adults had become impinged upon either the 1 or 2 mm screens during any period studied.

Some invertebrates were caught within the impingement net, but observations indicated that these organisms were not impinged, but were swimming and feeding in the vicinity of the screens when captured. Even captures of these organisms were infrequent. Some amphipods, largely Gammarus sp., were captured. These, however, were observed clinging to support wires and the screen end, as well as swimming near the screen surface. Many of these invertebrates were small enough to be otherwise entrained, so it is doubtful that there was any actual impingement observed.

5.2 ENTRAINMENT

The test screen intake was operated during Phases II and III of the test program. During those periods, entrainment was monitored as explained in the methodology section. The objective of the entrainment monitoring study was to collect data on the number and taxa of fish larvae, fish eggs, and macroinvertebrates entrained by the test screens and to compare them with numbers and taxa vulnerable to entrainment.

Entrainment collections were made from March through September 1979. A total of 134 entrainment collections was examined, including all screen sizes, time periods, and dates. Table 1 contains a list of fish taxa and life stages collected during the course of this study by collection method. Fish larvae and eggs were present in collections from the 1 mm test screen. Fish larvae, eggs, and two juveniles were present in collections entrained through the 2 mm test screen. Adult fish, juveniles, larvae, and eggs were collected through the open pipe intake (including the 9.5 mm screen).

Also listed on Table 1 are taxa and life stages of fish collected by tows. Adults, juveniles, larvae, and eggs were collected in tows. Actual densities of fish entrained during Phase II, expressed as numbers per 100 cubic meters (353 cubic feet), are presented in Appendix B, as are fish collected in net tows during the Phase II studies. Fish collected during

TABLE 1

SPECIES AND LIFE STAGES CAPTURED DURING SAMPLING, BY GEAR TYPE, DURING 1979
SEMINOLE ELECTRIC COOPERATIVE, INC.

Taxon	1 mm				2 mm				Open Pipe[b]				Tow			
	Adult	Juvenile	Larvae	Egg	Adult	Juvenile	Larvae	Egg	Adult	Juvenile	Larvae	Egg	Adult	Juvenile	Larvae	Egg
Ladyfish															X	
American eel													X	X		
Speckled worm eel														X		
Herring family											X			X	X	
Herring sp.											X			X	X	
Blueback herring														X		
Menhaden sp.															X	
Shad sp.															X	
Gizzard shad			X				X				X				X	
Threadfin shad							X						X	X		
Anchovy family			X				X									
Bay anchovy											X		X	X	X	
Minnow							X									
Golden shiner															X	
Atlantic needlefish							X				X		X		X	
Unidentified killifish						X[a]	X[a]								X	
Rainwater killifish			X				X				X		X		X	
Mosquitofish											X					
Silverside family			X				X								X	
Rough silverside			X				X						X		X	
Tidewater silverside			X	X			X	X			X	X	X	X	X	X
Atlantic silverside															X	
Sunfish sp.			X				X				X				X	
Bluegill									X							
Largemouth bass										X						
Spot														X		
Atlantic croaker											X			X	X	
Goby family			X				X				X				X	
Darter goby														X		
Naked goby			X				X			X	X		X	X	X	
Clown goby			X				X				X		X	X	X	
Bay whiff														X		
Hogchocker													X			
Unidentifiable			X	X			X				X				X	X

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[a] Identification uncertain.

[b] Includes 9.5 mm screen captures.

the Phase III monitoring study (both entrained and by net) are presented in Appendix C.

Data from the Phase II study are presented as contingency tables for each species and life stage by time block and day. Data are presented in this manner to be more amenable to analysis. The Phase III data are presented by date for all taxa and life stages. In terms of taxa collected, the 1 mm screen collected the lowest number of taxa (10). The 2 mm screen collected 14 taxa, and the open pipe (including 9.5 mm) 15 taxa.

To calculate entrainment of fish eggs and larvae, densities of ichthyoplankton for unsampled days were estimated using linear interpolation between temporally adjacent samples. Where day and night samples were taken, densities from actual day samples were used to estimate densities of ichthyoplankton during the day, and actual night samples were used to estimate densities at night. Since samples were only taken at night during the Phase II studies, it was assumed that densities for night and day were the same. This was a conservative assumption, since densities of ichthyoplankton collected during the day were consistently lower than those collected at night during Phase III. In addition, since the Phase II studies in late March through early April were performed during a period of high ichthyoplankton abundance, and then these figures used for estimating ichthyoplankton abundance between April and June 9, the abundance for the latter period was probably overestimated.

This process of estimation was performed for each time interval between samplings for each intake type: 1 mm slot-size screened intake, 2 mm slot-size screened intake, and unscreened (open pipe and 9.5 mm) intake, respectively. Although five sets (blocks) of samples were taken with the 9.5 mm screen during each day of Phase II, only the first four were used, since the fifth was taken in daylight and there were sharp differences in numbers from the other blocks.

Once densities were estimated for the intervening periods, two sets of entrainment estimates were calculated. The first, as a worst-case condition, was based upon the maximum makeup water flow for both proposed units, 107,653 m^3/d (3.80×10^6 ft^3/d). The second estimate was based upon the mean makeup water flow for both proposed units, (59,851 m^3/d (2.11×10^6 ft^3/d) which probably represents a much more realistic case.

That is,

$$Y_{et} = d_{et}\, Q_t$$

Y_{et} = total entrainment for a given taxon in period t

d_{et} = density of eggs or larvae of a given taxon during period t

Q_t = total makeup water withdrawn (either maximum or mean) during period t

and total entrainment for the period investigated is

$$Y_t = \sum_{1}^{11} Y_{et}$$

Y_t = total entrainment for a given taxon

The total estimated entrainment for each taxon is presented in Table 2. Estimated entrainments are presented separately for each screening device for both mean and maximum flows. It is clear that four taxa dominate the entrainment collections for both the 1 and 2 mm screens. These taxa are the family Atherinidae, and the species Menidia beryllina, Gobiosoma bosci, and Microgobius gulosus. Most of the remaining organisms were unidentifiable. Five major taxa that made up most of the estimated entrainment through the unscreened intake. These taxa were: Anchoa mitchilli, M. beryllina, Lepomis sp., G. bosci, and M. gulosus. As before, most of the remaining estimated entrainment was due to unidentifiable larvae.

TABLE 2

ESTIMATED NUMBERS OF FISH EGGS, LARVAE, AND JUVENILES POTENTIALLY ENTRAINABLE AT SEMINOLE UNITS NO. 1 AND NO. 2 BASED UPON DATA FOR MARCH 27 THROUGH SEPTEMBER 1, 1979

		Screen Size					
		1 mm		2 mm		Open Pipe	
Species	Life Stage	Maximum Flow	Mean Flow	Maximum Flow	Mean Flow	Maximum Flow	Mean Flow
Clupeidae	L					31,650	17,596
Engraulidae	L	7,234	4,022	86,359	48,012		
Anchoa mitchilli	L					495,344	275,392
Strongylura marina	L			3,445	1,915	19,033	10,582
Fundulus diaphanus	L			28,711	15,962		
Lucania parva	L	65,582	36,461	20,755	11,539	60,286	33,517
Atherinidae	L	762,001	423,643	296,670	164,937		
Membras martinica	L	10,356	5,758	51,071	28,393		
Menidia beryllina	E	86,510	48,096	29,131	16,196		
	L	3,170,015	1,762,408	3,144,458	1,748,200	4,218,921	2,345,561
Gambusia affinis	L					9,387	5,219
Lepomis sp.	L	128,538	71,462	115,070	63,975	828,821	460,793
Lepomis macrochirus	L					8,289	4,609
Micropterus salmoides	L					7,912	4,399

TABLE 2 (Continued)

Species	Life Stage	Screen Size					
		1 mm		2 mm		Open Pipe	
		Maximum Flow	Mean Flow	Maximum Flow	Mean Flow	Maximum Flow	Mean Flow
Gobiosoma bosci	L	10,402,639	5,783,474	10,181,444	5,660,498	23,955,688	13,318,458
Microgobius gulosus	L	954,505	530,668	3,199,523	1,778,814	25,614,686	14,240,799
Unidentified	E	3,445	1,915				
	L	8,156,330	4,534,611	9,008,317	5,008,284	14,345,710	7,975,672
Total	E	89,955	50,012	29,131	16,196		
	L	23,657,200	13,152,507	26,135,823	14,530,529	69,595,727	38,692,597

Maximum flow - maximum plant water use (107,653 m^3/day).
Mean flow - Mean makeup water requirement (59,851 m^3/day).

L = larvae, juvenile
E = egg

Examination of total numbers of larvae estimated to be entrained showed that the 1 mm and 2 mm screens offered reductions of 66 and 62 percent of the unscreened (open pipe) intake entrainments, respectively.

Larvae of some species were found throughout the periods studied. Most, however, were particularly abundant in collections for no more than 6 weeks.

Lengths of fish captured were also examined. There were few differences between the 1 mm and 2 mm screens in sizes of fish caught. Those fish entrained through the unscreened (open pipe) intake were generally of the same size ranges but quite frequently were larger than those entrained through the 1 and 2 mm screens. Fish captured in net tows usually had ranges of lengths far exceeding those in the entrainment samples (up to 350 mm on occasion).

Macroinvertebrates were relatively abundant in entrainment collections for all three intake types. There were relatively few differences between the three in taxa collected (Table 3). Densities of major macroinvertebrate taxa entrained during Phase II, in numbers per 100 cubic meters (353 ft^3), are summarized on contingency tables in Appendix B. Amphipods (particularly <u>Gammarus</u> sp.) and dipterans dominated the Phase II collections.

During Phase III studies (Appendix C), dipterans (particularly chironomids) and mysids (<u>Mysidopsis</u>) were the dominant entrained macroinvertebrates. There were considerable changes in the abundance of insect taxa during the course of the study. This was to be expected, since these aquatic life stages are almost always immature stages of adult forms that leave the water and are usually no longer vulnerable to entrainment. These macroinvertebrates were extremely abundant, as indicated by their capture in the various entrainment collections.

TABLE 3

TAXA OF MACROINVERTEBRATES COLLECTED BY ENTRAINMENT SEMINOLE PLANT UNITS NO. 1 AND NO. 2 SEMINOLE ELECTRIC COOPERATIVE, INC.

Taxa	1 mm Entrainment	2 mm Entrainment	Open Pipe 9.5 mm (3/8") Entrainment
Insecta			
Ephemeroptera			
Caenidae		X	
Caenis sp.	X	X	X
Trichoptera	X		
Psychomyiidae	X	X	X
Leptoceridae	X		
Hydroptilidae	X		
Limnophilidae		X	X
Diptera			
Chironomidae	X	X	X
Chironominae	X		X
Chironomini	X	X	X
Tanypodinae	X	X	X
Coelotanypus sp.	X	X	
Procladius sp.	X		X
Ablabesmyia sp.	X		
Orthocladiinae	X	X	
Ceratopogonidae	X	X	X
Culicidae			
Chaoborus sp.	X	X	X
Hemiptera	X	X	X
Coleoptera			
Corixidae	X	X	X
Unidentified sp.	X	X	X
Odonata			
Anisoptera			
Gomphidae		X	
Zygoptera			
Coenagrionidae		X	
Enallagma sp.	X	X	X
Arachnoidea			
Hydracarina	X	X	X
Annelida			
Oligochaeta			
Naididae	X		
Nematoda		X	

TABLE 3 (Continued)

Taxa	1 mm Entrainment	2 mm Entrainment	Open Pipe 9.5 mm (3/8") Entrainment
Crustacea			
Amphipoda	X	X	X
Gammaridae			
Gammarus sp.	X	X	X
Oediceratidae			
Monoculodes edwardsi	X	X	X
Talitridae			
Hyalella sp.	X	X	X
Corophiidae			
Corophium sp.	X	X	X
Isopoda	X	X	X
Bopyridae			
Probopyrus sp.	X		X
Anthuridae			
Cyathura polita	X	X	X
Idoteidae			
Chiridotea coeca	X	X	X
Sphaeromatidae			
Cassidinidea lunifrons	X	X	X
Sphaeroma destructor	X	X	X
Mysidacea		X	
Mysidae			
Mysidopsis bigelowi	X	X	X
Decapoda			
Portunidae			
Callinectes sp.			X
Ostracoda			
Podocopa	X		
Mollusca			
Gastropoda			

Estimated entrained numbers of wholly aquatic macroinvertebrates of major taxonomic groups were calculated in the same way as previously done for entrained fish. These estimates are presented in Table 4. Only wholly aquatic taxa were used, since other groups are only vulnerable for limited periods of their life cycles.

In general, there is not a great deal of difference between the estimates for the three intake types. An exception to this is the estimated entrainment of mysids. Estimated numbers of mysids entrained through the unscreened intake are considerably higher (approximately 9 times greater) than those entrained through either the 1 or 2 mm screens.

5.3 TOWS

As discussed in the methodology section, net tows were used to provide additional information on fish life stages present in the St. Johns River during entrainment studies. Net tow studies were performed during both Phase II and Phase III studies.

Densities of the various life stages of fish collected in net tows during Phase II studies are listed in summary contingency tables in Appendix B. Tows taken during the Phase II study were taken at approximately 99.1 m (325 ft) from shore, 22.9 m (75 ft) offshore of the test intake. That distance was chosen to be representative of the actual proposed plant intake (also 99.1 m [325 ft] from shore) and to avoid any possibility of interference with the Phase II screen tests. Examination of these tows indicated that densities of fish life stages (Appendix B) and taxa present differed from those collected at the test intake. Some of these same differences in taxa and numbers were also found during the intake location study (Appendix A) and constituted some of the main reasons why the proposed intake was located at 99.1 m (325 ft) from shore. The fish collected in the net tows

TABLE 4

ESTIMATED NUMBERS OF WHOLLY AQUATIC MAJOR MACROINVERTEBRATE GROUPS POTENTIALLY ENTRAINABLE AT SECI UNITS #1 AND 2 BASED UPON DATA FROM MARCH 27 THROUGH SEPTEMBER 1, 1979 BY INTAKE TYPE AND FLOW

	1 mm		2 mm		Open Pipe[a]	
Taxa	Maximum Flow[b]	Mean Flow[b]	Maximum Flow[b]	Mean Flow[b]	Maximum Flow[b]	Mean Flow[b]
Hydracarina	4,620,226	2,568,671	6,073,880	3,376,848	2,622,838	1,458,199
Amphipoda	87,344,418	48,560,196	92,316,280	51,324,363	140,808,919	78,284,438
Isopoda	8,947,284	4,974,352	9,516,533	5,290,833	9,343,452	5,194,606
Mysidacea	54,018,393	30,032,185	46,717,774	25,973,317	487,191,351	270,859,981

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[a] Includes 9.5 mm screen

[b] All life stages and subtaxa

were generally larger, older life stages less vulnerable to entrainment than those found further in-shore. For these reasons, comparisons between net tows and entrained collections made during Phase II of the study were not carried further, and entrainment collections made at the test intake may be considered to be conservative.

During Phase III studies, tows were conducted as close to the test intake as feasible. Tows during Phase III were taken approximately 83.8 m (275 ft) from shore. During this phase, tows were conducted during both day and night. Densities of fish collected by net tows are reported in Appendix C (Tables C-1 through C-5).

Comparative examination of unscreened (open pipe) intake and larval tow data during Phase III showed that during the day fish apparently avoided the larval net. This was also observed visually - "schools" of larvae in the water appeared to avoid the net. This phenomenon of net avoidance has been observed previously and has been reported in the literature (Ahlstrom, 1954; Bowles and Merrimer, 1978). During the night, on the other hand, the net tows and unscreened intake collected very similar densities of fish (Appendix C, Tables C-1 through C-5).

5.4 SCREEN COMPARISONS

One of the principal reasons for conducting these studies was to determine whether there was any difference in the efficiency of impact mitigation by the 1 mm and 2 mm slot-size screens. This was the principal reason for the performance of the Phase II studies. The experimental design of that test was set up to allow both numerical and statistical comparisons between the entrainment collections made through the two slot sizes. The last was designed so that both the analysis of variance (ANOVA) and analysis of covariance (COVAR) procedures could be used. The COVAR procedure allowed an increase in the power of the test if marked numerical differences could not otherwise be differentiated statistically.

The test design utilized a number of variables (or effects). These were days (day of sampling), blocks (time of day), screens (1 mm or 2 mm test screens), and position within block (position of screen on test dock during each block). The position within block was assigned by use of a random number table (see 4.3, Methodology). The statistical procedures used (Ostle and Mensing, 1975; Kempthorne, 1973) assumed the following model:

$$Y_{ijkm} = D_i + B_k + (TB)_{jk} + P_m + E_{ijkm}$$

Y_{ijkm} = number of fish entrained on day i at position; within block k through screen m, corrected for volume

D_i = number of fish entrained due to the effect of day i

B_k = number of fish entrained due to the effect of block k

P_m = number of fish entrained due to the effect of screen m

$(TB)_{jk}$ = number of fish entrained due to the random effect of position of screen on lock during block

E_{ijkm} = effect of random error, independent normal distribution $(0,\sigma^2)$

Analysis of the Phase II data, as summarized in the contingency tables in Appendix B, was conducted by use of a statistical analysis program. Each taxon was tested for each life stage present. Results of each ANOVA were also subjected to Cochran's test (Winer, 1962) to determine if the homogeneity of variance met the assumptions of the ANOVA model. Where assumptions were violated for actual densities, data were transformed using the $\log_{10}$ (density + 1) or square root transformations and then analyzed. If the transformed data then met the assumptions of the ANOVA model, these results were used.

Examination of the results of the ANOVA (Table 5) showed that there were no statistically significant differences ($p >> 0.05$) between the 1 mm and 2 mm screens in terms of densities of fish entrained. This was true for all taxa and life stages. An examination of all larvae for all taxa of fish entrained during the Phase II study showed that even numerical differences were small, with the 2 mm screen entraining 7.7 fewer larvae (for all taxa) per 100 m^3 of water. This was a difference of less than 8 percent of the densities entrained by the 1 mm screen. Due to the lack of any clear numerical differences in the densities entrained by the two screens, it was decided that use of the COVAR procedure was unnecessary.

Although there were no statistically significant differences between entrainments through the two screens, there were significant differences ($p \leq 0.05$) found between days of study and between time blocks ($p \leq 0.10$). Such variations are typical of fish activity and of weather conditions and other natural variations. One particular meteorological (and/or river) variable had a strong effect on the densities of larvae entrained. Wind speed and river surface (waves) correlated at a statistically significant ($p \leq 0.02$) level with larvae entrained. It is probable that the turbulence in the near-shore zone "stirred up" larvae present near shore and increased the density of larvae in the vicinity of the test screens, thus increasing the numbers of larvae vulnerable to entrainment. Increases in densities of larvae in the water column were also found in tows, but differences and densities were much less than those collected by entrainment. This indicated that the siting of the intake at 99.1 m (325 ft) from shore would decrease the probability and extent of increases in entrainment due to increased near-shore turbulence.

TABLE 5

RESULTS OF VARIANCE FOR LARVAL FISH DURING PHASE II STUDIES
1 AND 2 MM SCREEN RESULTS
SEMINOLE ELECTRIC COOPERATIVE, INC.
MARCH-APRIL 1979

Taxa	Life Stage[a]	Effect Probabilities				Data Type[b]
		Days	Blocks	Positions/ Blocks	Screens	
Dorosoma cepedianum	LA	$p>0.25$	$p>0.25$	$p>0.25$	$p>0.25$	A
Dorosoma cepedianum	PL	$p>0.25$	$P<0.25$	$P0.25$	$p>0.25$	A
Dorosoma petenense	LA	$p>0.25$	$p>0.25$	$p>0.25$	$p>0.25$	A
Strongylura marina	PL	$p>0.25$	$p>0.25$	$p>0.25$	$p>0.25$	A
Strongylura marina	LA	$p>0.25$	$p>0.25$	$p>0.25$	$p>0.25$	A
Fundulus sp.	PR	$p>0.25$	$p>0.25$	$P<0.25$	$p>0.25$	A
Fundulus sp.	LA	$p>0.25$	$p>0.25$	$p>0.25$	$p>0.25$	A
Lucania parva	PL	$p<0.0005$	$0.25>p>0.10$	$p>0.25$	$p>0.25$	L
Lucania parva	LA	$0.0025>p>0.001$	$0.25>p>0.10$	$p>0.25$	$p>0.25$	A
Menidia beryllina	PR	$p>0.25$	$0.25>p>0.10$	$p>0.25$	$0.25>p>0.10$	A
Menidia beryllina	PL	$0.005> p>0.0025$	$0.10>p>0.05$	$p>0.25$	$p>0.25$	A

---

[a] LA = All Larvae; PL - Postlarvae; PR = Prolarvae

[b] A = Actual densities; L = Log (+1) transform; S = Square root transform

TABLE 5 (Continued)

Taxa	Life Stage[a]	Effect Probabilities				Data Type[b]
		Days	Blocks	Positions/ Blocks	Screens	
Menidia beryllina	LA	$0.001 > p > 0.0005$	$0.25 > p > 0.10$	$p > 0.25$	$p > 0.25$	A
Gobiosoma bosci	PL	$p > 0.25$	$p > 0.25$	$p > 0.25$	$p > 0.25$	A
Gobiosoma bosci	LA	$p > 0.25$	$p > 0.25$	$p > 0.25$	$p > 0.25$	A

Examinations of entrainment collections made during the Phase III studies (Appendix C) showed that densities of collections taken through both the 1 mm and 2 mm screens were similar, particularly during the first half of that study, although 1 mm entrainments tended to be lower. During the latter part of that study, densities entrained through the 1 mm screen were greater than those entrained through the 2 mm screen. This may have been in part due to fouling and partial plugging of the 1 mm screen in August 1979, leading to higher slot velocities (discussed under biofouling below) and subsequent increased entrainment.

5.5 MITIGATION

The Phase III study was specifically designed to address both mitigation of entrainment and biofouling. Since essentially no impingement of fish had occurred and the apparent impingement of macroinvertebrates (as discussed in Subsection 5.1, Impingement) was probably representative of their presence near the screen rather than their impingement on it, it was concluded that impingement was almost completely mitigated.

Table 6 consists of listings of entrainment collections for the 1 mm screen and for the 2 mm screen, presented as percentages of entrainment through the open pipe. Since net tows taken at night did not exhibit net avoidance by fish, fish densities in 1 mm and 2 mm screen night entrainment collections were compared to those found in night net collections. These comparisons were also expressed as percentages. Comparisons were made both for each taxon and life stage found and for total numbers of organisms. Blanks indicate taxa or life stages that were absent; zeros indicate taxa present in the denominator collection (from the open pipe). For the 20 comparisons of total number of organisms between the 1 mm screen and unscreened intake (open pipe) and the 2 mm screen and unscreened intake,

TABLE 6

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 7, 1979

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Clupeidae	L		
	J		
Alosa sp.	J		
Alosa aestivalis	L		
	J		
Dorosoma petenense	J		
Engraulidae	L		
Anchoa mitchilli	L		
	J		
	A		
Strongylura marina	L		
	A		
Fundulus diaphanus	L		
Lucania parva	L		
Atherinidae	L		
Membras martinica	L		
Menidia beryllina	E		
	L	38.28	12.79
	J		
Menidia menidia	L		
Lepomis sp.	L	0	0
Lepomis macrochirus	A		
Micropterus salmoides	J		
Gobiidae	L	3.96	0
Gobiosoma bosci	L		
	J		
	A		

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Microgobius gulosus	L		
	J		
	A		
Trinectes maculatus	A		
Unidentified	L	10.55	5.27
Ratio of Totals		8.37	2.99

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
NIGHT - JUNE 7, 1979

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Clupeidae	L				
	J				
Alosa sp.	J				
Alosa aestivalis	L				
	J		0		0
Dorosoma petenense	J				
Engraulidae	L				
Anchoa mitchilli	L				
	J				
	A				
Strongylura marina	L				
	A				
Fundulus diaphanus	L				
Lucania parva	L	-	-		
Atherinidae	L				
Membras martinica	L				
Menidia beryllina	E		0		0
	L		0		0
	J		0		0
Menidia menidia	L				
Lepomis sp.	L				
Lepomis macrochirus	A				
Micropterus salmoides	J				
Gobiidae	L	3.44	3.42	0	0
Gobiosoma bosci	L		0		0
	J		0		0
	A				

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Microgobius gulosus	L J A		0		0
Trinectes maculatus	A				
Unidentified	L	27.57	2954.21	23.72	2541.58
Ratio of Totals		12.08	16.54	8.28	11.33

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JULY 13, 1979

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Clupeidae	L		
	J		
Alosa sp.	J		
Alosa aestivalis	L		
	J		
Dorosoma petenense	J		
Engraulidae	L		
Anchoa mitchilli	L		
	J		
	A		
Strongylura marina	L		
	A		
Fundulus diaphanus	L		
Lucania parva	L		
Atherinidae	L		
Membras martinica	L		
Menidia beryllina	E		
	L		
	J		
Menidia menidia	L		
Lepomis sp.	L	0	0
Lepomis macrochirus	A		
Micropterus salmoides	J		
Gobiidae	L	67.66	22.55
Gobiosoma bosci	L		
	J		
	A		

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Microgobius gulosus	L		
	J		
	A		
Trinectes maculatus	A		
Unidentified	L	85.38	52.18
Ratio of Totals		77.28	41.86

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 23, 1979

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Clupeidae	L	0	0
	J		
Alosa sp.	J		
Alosa aestivalis	L		
	J		
Dorosoma petenense	J		
Engraulidae	L		
Anchoa mitchilli	L		
	J		
	A		
Strongylura marina	L		
	A		
Fundulus diaphanus	L		
Lucania parva	L		
Atherinidae	L		
Membras martinica	L		
Menidia beryllina	E		
	L		
	J		
Menidia menidia	L		
Lepomis sp.	L		
Lepomis macrochirus	A		
Micropterus salmoides	J	0	0
Gobiidae	L	0	0
Gobiosoma bosci	L		
	J		
	A		

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Microgobius gulosus	L	0	0
	J		
	A		
Trinectes maculatus	A		
Unidentified	L		
Ratio of Totals		0	0

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
NIGHT - JUNE 23, 1979

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Clupeidae	L		0		0
	J				
Alosa sp.	J		0		0
Alosa aestivalis	L				
	J				
Dorosoma petenense	J				
Engraulidae	L				
Anchoa mitchilli	L		0		0
	J		0		0
	A				
Strongylura marina	L				
	A				
Fundulus diaphanus	L				
Lucania parva	L				
Atherinidae	L	-	-	-	-
Membras martinica	L				
Menidia beryllina	E				
	L			-	-
	J		0		0
Menidia menidia	L				
Lepomis sp.	L				
Lepomis macrochirus	A				
Micropterus salmoides	J				
Gobiidae	L	25.50	13.38	63.19	33.16
Gobiosoma bosci	L	0	0	5.53	0.92
	J				
	A				

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Microgobius gulosus	L	0	0	5.34	27.69
	J		0		0
	A		0		0
Trinectes maculatus	A				
Unidentified	L	93.84	-	70.08	-
Ratio of Totals		28.55	21.00	36.59	26.91

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
NIGHT - JULY 12, 1979

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Clupeidae	L		0		0
	J				
Alosa sp.	J				
Alosa aestivalis	L				
	J				
Dorosoma petenense	J				
Engraulidae	L	-	-	-	-
Anchoa mitchilli	L	0	0	0	0
	J				
	A				
Strongylura marina	L				
	A				
Fundulus diaphanus	L		0	-	201.19
Lucania parva	L				
Atherinidae	L	-	-	-	-
Membras martinica	L				
Menidia beryllina	E				
	L	0	0	0	0
	J				
Menidia menidia	L				
Lepomis sp.	L	65.01	57.42	130.01	114.83
Lepomis macrochirus	A				
Micropterus salmoides	J				
Gobiidae	L	67.29	49.12	113.76	83.05
Gobiosoma bosci	L	16.26	1.05	195.06	12.56
	J				
	A		0		0

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Microgobius gulosus	L			8.48	18.27
	J				
	A		0		0
Trinectes maculatus	A				
Unidentified	L	72.32	-	107.26	-
Ratio of Totals		51.51	28.95	92.00	51.71

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - AUGUST 9, 1979

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Clupeidae	L		
	J		
Alosa sp.	J		
Alosa aestivalis	L		
	J		
Dorosoma petenense	J		
Engraulidae	L		
Anchoa mitchilli	L		
	J		
	A		
Strongylura marina	L		
	A		
Fundulus diaphanus	L		
Lucania parva	L		
Atherinidae	L		
Membras martinica	L	-	-
Menidia beryllina	E		
	L	-	-
	J		
Menidia menidia	L		
Lepomis sp.	L	0	0
Lepomis macrochirus	A		
Micropterus salmoides	J		
Gobiidae	L	2.75	1.57
Gobiosoma bosci	L	0	0
	J		
	A		

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Microgobius gulosus	L	14.28	1.99	0	0
	J		0		0
	A				
Trinectes maculatus	A		0		0
Unidentified	L	117.85	-	114.28	-
Ratio of Totals		101.49	13.09	97.02	12.51

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

ENTRAINMENT BY 1 AND 2 MM SCREENS
(Expressed as % of Unscreened Entrainment)
SEMINOLE ELECTRIC COOPERATIVE, INC.
NIGHT - AUGUST 31, 1979

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Clupeidae	L				
	J		0		0
Alosa sp.	J				
Alosa aestivalis	L				
	J				
Dorosoma petenense	J				
Engraulidae	L				
Anchoa mitchilli	L		0		0
	J				
	A		0		0
Strongylura marina	L				
	A		0		0
Fundulus diaphanus	L				
Lucania parva	L				
Atherinidae	L	-	-	-	-
Membras martinica	L				14.96
Menidia beryllina	E				
	L		0		0
	J				
Menidia menidia	L				
Lepomis sp.	L	0	0	0	0
Lepomis macrochirus	A				
Micropterus salmoides	J				
Gobiidae	L	87.78	226.54	53.33	137.64
Gobiosoma bosci	L	23.13	12.24	7.48	3.96
	J		0		0
	A				

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	1 mm/Tows	2 mm/Open	2 mm/Tows
Microgobius gulosus	L J A	4.17	13.55	0	0
Trinectes maculatus	A				
Unidentified	L	-	3766.78	-	3065.94
Ratio of Totals		62.74	49.78	38.40	30.47

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

TABLE 6 (Continued)

Species	Life Stage[a]	1 mm/Open	2 mm/Open
Microgobius gulosus	L	-	
	J		
	A		
Trinectes maculatus	A		
Unidentified	L	46.58	32.25
Ratio of Totals		68.54	48.95

---

[a] E = Eggs
L = Larvae
J = Juvenile
A = Adult

the screened intakes had percentage entrainments varying between 0 and 101 percent, that is between 0 times and 1.01 times as many fish as collected through the open pipe. Out of the 20 comparisons: 16 (or 80 percent) showed that screened intakes took at least 30 percent less fish than the unscreened intake, and 13 (or 65 percent) showed that screened intakes took at least 50 percent less fish.

Number of times Screens <50% open pipe	Number of Times <70%	Number of Times >80%
13	16	4

Until the latter part of the Phase III study, percentage entrainment by the 1 mm or 2 mm screens during the day was extremely low. It is probable that increased fouling contributed to higher entrainments observed at that time. Fouling growths were particularly abundant on the screens during the August 9, 1979 sampling. Therefore, percentage entrainments from June through July were examined as being more indicative of unfouled screens. These broke down as follows, for 12 comparisons made:

Number of times Screens <50% open pipe	Number of Times <70%	Number of Times >80%
9	10	2

That is, 9 (75 percent) of the entrainment collections through the 1 and 2 mm screens represented reductions of at least 50 percent over entrainments through the unscreened intake, and 10 (83.3 percent) of the 12 collections showed reductions of more than 30 percent.

Comparisons with tows were made for night sampling only. In all, 10 comparisons were made, five for 1 mm screen entrainment versus tows and five for 2 mm screen entrainment versus tows. In the 10 comparisons, none of the densities of fish collected through the screens was greater than 52 percent of those taken in the tows. Eight of the 10 comparisons showed screen collections of less than 33 percent of the totals for the tows, an exclusion of 2/3 of fish present. Overall, this shows a substantial reduction in potential entrainment through the use of fine-slot screens.

During this same study phase (Phase III), adult fish were captured in both the larval tows and the open pipe intake. No adults were (or could be, because of the slot sizes) entrained through the fine-slot screens. In addition, largemouth bass (Micropterus salmoides), an important recreational species, were collected with the unscreened intake, while none was collected through the 1 mm or 2 mm screen. Laboratory tests conducted by the TVA indicated high bypass of M. salmoides and other centrarchids past wedge-wire screens (Heuer and Tomljanovich, 1979).

5.6 BIOFOULING

The third objective of the testing program was to determine if the stainless steel fine-slot wedge-wire screens could be operated reliably in the St. Johns River. Reliability in this case means that they could be operated successfully for extended periods without loss of capacity (decreased flow) or excessive fouling. A flow-sensitive switch was installed on the pump system to shut the pump off if the screens became sufficiently plugged to reduce flow by 25 percent. The pumps were checked twice daily, and various physical measurements of river conditions were made.

In previous studies (Hanson et al., 1978), fouling of the screens was associated with biological growth. During each of the Phase III entrainment samplings, the screens were examined to identify biofouling growths and types of debris. This study was conducted from mid-May through the beginning of September. The screens and screen positions were not subject to switching or other disturbance throughout the study, except during biological sampling once every 2-4 weeks.

Intake flows and water temperatures for this period are plotted on Figure 12. It is clear that there was no drop in flow rate greater than 25 percent during this study and that flow rate remained very close to the initial rate of 225 gpm. The 1 mm wedge-wire screen had more shifts in flow than the 2 mm wedge-wire screen, but there was no clear pattern in these shifts.

In previous studies (Hanson et al., 1978) biofouling-induced shutdowns (lack of flow) were related to water temperatures; the hydroid *Garveia franciscana* was found to be responsible for most of the fouling effects.

Most of the biological growth on the screens observed in this study consisted of the hydroid *Cordylophora lacustris*, which is common in fresh to brackish water areas of estuaries. Small amounts of various blue-green algae, green algae, and diatoms were found among this growth. These included: *Lyngbya*, *Mougeotia*, *Melosira*, and various naviculoids, as shown on Table 7. The organisms were found on both screens. Once the hydroid growth was established, a number of invertebrates, including tubificids and chironomids, were found among this "new habitat."

Fouling growths of *C. lacustris* were found to show a high degree of zonation on the screens. Almost all growth occurred on the upper surfaces of the screens, with relatively little growth on the underside. This would appear to indicate that the growth may have been related to light associated with the growth of periphytic organisms.

Detritus and detritus fouling did not appear to be a problem. The amount of detritus found on the screens was usually no more than one or two blades of *Vallisneria americana* and some unidentified root hairs and other organic detritus. Detritus was found on the screens most often where biofouling growths were present on the screen surface.

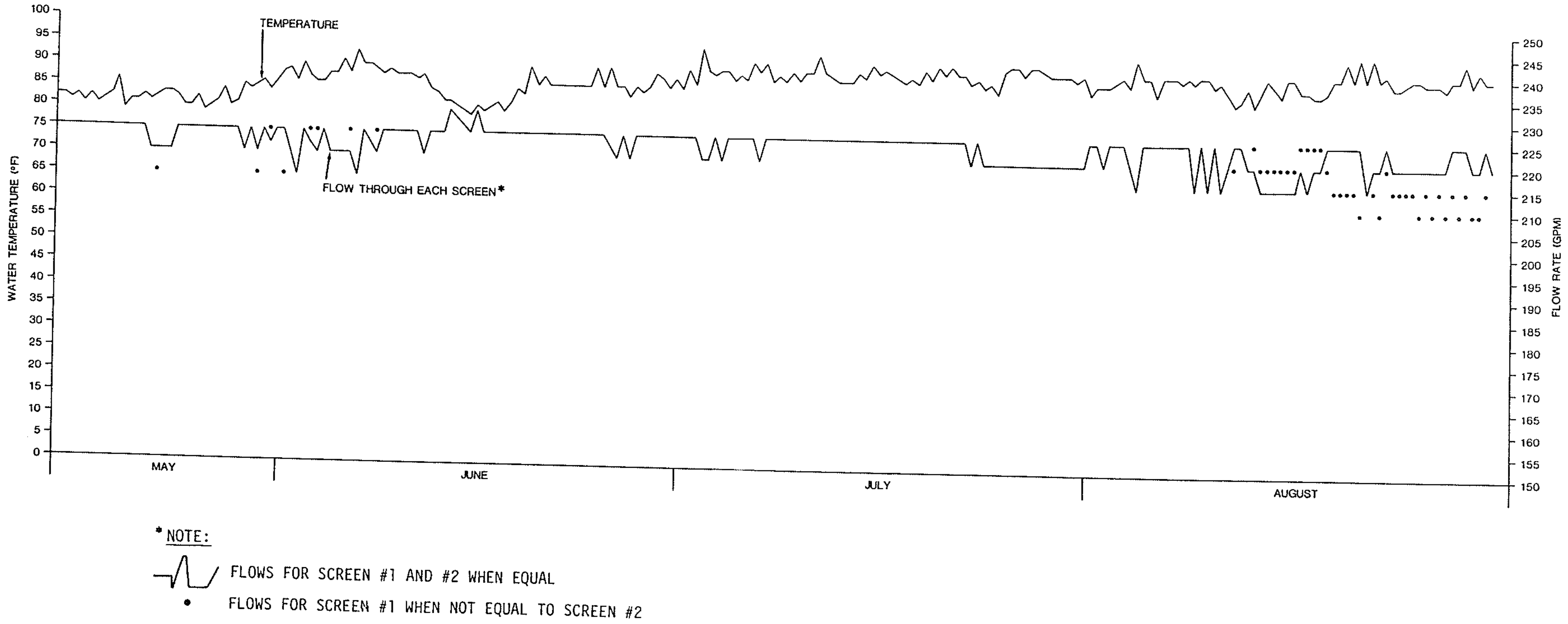

FIGURE 12
BIOFOULING TEST SCREEN PERFORMANCE RESULTS
SEMINOLE PLANT UNITS NO. 1 AND NO. 2
SEMINOLE ELECTRIC COOPERATIVE, INC.

TABLE 7

FOULING GROWTH AND ASSOCIATED ORGANISMS COLLECTED ON SCREENS DURING BIOFOULING STUDIES SEMINOLE ELECTRIC COOPERATIVE, INC. JUNE - SEPTEMBER 1979

BLUE-GREENS

Anabaena sp.
Lyngbya contorta
L. Nordgoardii
L. sp

DIATOMS

Cocconeis
Coscinodiscus rothii
Cyclotella meneghiniana
C. sp.
Fragilaria sp.
Gomphonema sp.
Melosira ambigua
M. sp.
Navicula sp.

GREENS

Aphanochaete sp.
Characium sp.
Mougeotia sp.
Oedogonium sp.
Pediastrum sp.
Scenedesmus sp.
Spirogyra sp.

CHAROPHYTES

Chara sp.

MACROPHYTE PLANTS

Vallisneria americana

HYDROIDS

Cordylophora lacustris

OTHER INVERTEBRATES

Tubificidae
Chironomidae

Although during the course of the study there were some small shifts in flow, neither biofouling nor detrital fouling appeared to cause significant loss of capacity or otherwise adversely affect the feasibility of screen use. Since the study was conducted during the period of highest temperature and greatest biological growth, it was concluded that biofouling will probably not be a problem at the proposed intake site.

Measurements of approach velocity to the screens showed that fouling increased velocities during the course of the study by decreasing open area. Approach velocities to the 1 mm screen measured at 0.5 ft (0.15 m) with a Marsh McBirney 201 flow meter were 0.10 fps (0.03 mps) with the screen clean, but increased to 0.20 fps (0.06 mps) in September when the screen had the greatest amount of biofouling. Approach velocities to the 2 mm screen increased from 0.06 fps (0.02 mps) with the screens clean to 0.15 fps (0.045 mps) in September. These velocities are still substantially less than the 0.5 fps (0.15 mps) recommended as acceptable by USEPA (1976), and were measured at half the normal distance of measurement (0.30 m or 1 ft); they are therefore substantially higher than velocities that would be found at 0.30 m (1 ft).

During the September examination of screen approach velocities, velocities at 0.30 m (1 ft) from the screen face for both the 1 and 2 mm screens were always 0.10 fps (0.03 mps) or less. Examinations of velocities 0.08 m (0.25 ft) from the screen surface indicated both front to back and side to side differences in approach velocity in September. Highest velocities were found under the screen, where the open screen area was greatest. Since most of the flow was passing through this reduced area, higher velocities were expected. Velocities along the bottom of the 1 mm screen averaged 0.47 fps (0.14 mps) and 0.35 fps (0.11 mps) along the bottom of the 2 mm screen.

It should be noted that the 1 mm screen appeared to be more heavily fouled than the 2 mm screen. Higher approach velocities tended to accelerate debris clogging and appeared to increase entrainment. A regular screen cleaning program should improve screen performance.

6.0 ANALYSIS

The operational feasibility of fine-slot opening stationary screens with low approach velocities has been shown at the plant site and has been chosen for the proposed plant intake (Section 3.4). It therefore remains to assess the impacts of its operation and assess the extent of mitigation in determining BTA. These, then will, be the two principal issues addressed here.

6.1 ASSESSMENT OF IMPACTS

In evaluating the effects of the loss of fish from a community and in determining impacts, one difficulty normally faced is the rather limited knowledge available concerning fish communities and the population biology of many fish species. The St. Johns River, in particular, unlike certain other waterbodies, has a rather small data base. An evaluative approach, using quantitative data, quantitative assessment, and qualitative interpretation, therefore seemed most appropriate.

Since test intakes were actually operated at the site of the proposed intake and since entrainment was estimated in a conservative manner, an estimate of actual numbers of fish that could potentially be entrained is available (Table 3). Since the only fish life stages vulnerable to this intake are eggs, larvae, and some juveniles, some interpretation of what these numbers actually mean was required.

For fish populations in equilibrium, no matter how many times a fish reproduces and no matter how many eggs and larvae are produced each time, only one egg survives to maturity to replace each adult that spawned it. It is for this reason that egg and larval survival rates, especially for very fecund forage fish, are extremely low (one per 10,000 or lower).

The older a fish becomes, from embryo to larva, from larva to juvenile, the higher its chance of surviving to maturity.

Utilizing a simple population model as defined by Horst (1975) and suggested by the USEPA (1977) (and subsequently expounded upon by Horst, unpublished; 1977a, 1977b; Saunders, 1977; Dahlberg, 1977; Goodyear, 1978, etc.), an estimate has been made of the number of potential adults lost from fish populations due to the entrainment of larvae, eggs, and juveniles.

The model is developed as follows (Horst, 1975). If a population is in equilibrium, in one generation the total offspring produced by a pair of breeding adults will be reduced to a second single pair of breeding adults. That is:

$$2 = Se \cdot F$$

Se = the survival from egg to adult

F = the fecundity of a female during her lifetime

Therefore, if an entrained life stage is an egg, the estimate of the number of adults lost is:

$$Na = SeNe = \frac{2}{F} Ne$$

Na = number of adults reaching maturity assuming no density dependence

Ne = number of eggs entrained

2 = number of adults needed to be produced by a breeding pair

Where the entrained life stage is a larva:

$$Na = S_1 \, N_1 = \frac{2}{S_{e1}} F \cdot N_1$$

S_1 = survival from larva to adult stage
S_{e1} = survival from egg to larvae
N_1 - number of larvae entrained

This model makes several assumptions (Horst, 1977):

-The population is in equilibrium and is density independent.

-The sex ratio is equal and does not change.

-The lifetime of a fish in the population is equivalent to the mean generation time (MGT).

-Removal of eggs occurs when they are laid.

-Removal of larvae occurs when they hatch.

-Age distribution of the population is stable.

Since the model assumes no density dependence or compensation for losses, it systematically ignores the fact that without such compensation, all forage fish species would be extinct due to exploitation by predators; it is therefore inherently conservative. Therefore, if this "equivalent adult" model indicates levels of adverse impact that can be considered acceptable, refinements of the model that make it more realistic should not cause much deviation from the results obtained (Horst, unpublished). Since the amount of information required for even this simple model was more than was available in the literature (reviewed for vulnerable species in Appendix D), information obtained during these studies and by discussion with scientists in the area was used.

In addition, when survival rates were not available or could not be calculated (for egg to larval stage, for example) and parents care for offspring (e.g., Gobiosoma bosci), 50 percent survival from egg to larvae was assumed (Sel = 0.50). This also represents a conservative assumption. Sufficient data were available on five species vulnerable to the 1 mm and 2 mm screens to estimate losses of "equivalent adults" for the proposed power plant. Losses of "equivalent adults" for Lucania parva, Menidia beryllina, G. bosci, Microgobius gulosus, and Lepomis sp. were calculated. Estimates were also made for both maximum and mean flows. Biomass of "equivalent adults" lost was estimated based upon weights of fish actually measured in the St. Johns River. These results are shown in Table 8. These species, in general, were those most vulnerable to the 1 and 2 mm screen intakes.

TABLE 8

CALCULATIONS OF LOSS OF ADULT FORAGE AND GAME FISH DUE TO ENTRAINMENT OF EGGS, LARVAE, AND JUVENILE FORAGE FISH AT SEMINOLE ELECTRIC COOPERATIVE, INC., FROM MARCH 27 THROUGH SEPTEMBER 1, 1979

Species	Screen Size	Number Entrained		Lifetime Fecundity	Survival Egg to Larva	Survival Larva to Adult	Numbers of Adults Lost		Weight[a] (kg) of Adults Lost		Weight[b] (kg) of Game Fish Lost	
		Maximum Flow	Mean Flow				Maximum Flow	Mean Flow	Maximum Flow	Mean Flow	Maximum Flow	Mean Flow
Lucania parva	1 mm	65,582	36,461	49	0.10	0.41	26,889	14,949	54	30	10.8	6.0
	2mm	20,755	11,539	49	0.10	0.41	8,510	4,731	17	9	3.4	1.8
	Open pipe[c]	60,286[c]	33,517[c]	49	0.10	0.41	24,717	13,741	49	27	9.8	5.4
Menidia beryllina	1 mm	86,510[d]	48,096[d]	1,218	0.10	0.016	50,859	28,275	102	57	20.4	11.4
		3,170,015	1,762,409	1,218	0.10	0.016						
	2 mm	29,131[d]	16,196[d]	1,218	0.10	0.016	50,358	27,997	101	56	20.2	11.2
		3,144,458	1,748,200	1,218	0.10	0.016						
	Open pipe	4,218,921[c]	2,345,561[c]	1,218	0.10	0.016	67,503	37,528	135	75	27.0	15.0
Gobiosoma bosci	1 mm	10,402,639	5,783,474	1,166	0.50	0.0034	35,369	19,664	71	39	14.2	7.8
	2 mm	10,181,444	5,660,498	1,166	0.50	0.0034	34,617	19,246	69	38	13.8	7.6
	Open pipe	23,955,688	13,318,458	1,166	0.50	0.0034	81,449	45,283	163	91	32.6	18.2
Microgobius gulosus	1 mm	954,504	530,668	620	0.10	0.032	30,544	16,981	61	34	12.2	6.8
	2 mm	3,199,523	1,778,814	620	0.10	0.032	102,385	56,922	205	114	41.0	22.8
	Open pipe	25,614,686	14,240,799	620	0.10	0.032	819,670	455,706	1,639	911	327.8	182.2
Lepomis sp.[e]	1 mm	125,538	71,462	97,000	0.75	0.00003	3	2	0.9	0.6	0.9	0.6
	2 mm	115,070	63,975	97,000	0.75	0.00003	3	1	0.9	0.3	0.9	0.3
	Open pipe	837,110	465,402	97,000	0.75	0.00003	19	10	5.4	2.8	5.4	2.8

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[a] Based on 0.002 kg/fish average weight

[b] Based on conversion efficiency of 0.20 biomass accumulated/biomass eaten after Odum, 1970

[c] May be underestimated for actual open pipe; majority entrained while 3/8-inch screen in place

[d] Eggs, other numbers represent larvae and juveniles

[e] Assumed to be *L. macrochirus*; bluegills are game fish with MGT mean biomass of 0.30 kg

Since four of the five species above were forage species, it was determined that the equivalent weight of game fish production, that is biomass, lost should be examined. Examination of the literature indicated that the conversion of biomass from one trophic level to the next occurs at an efficiency of between 10 and 20 percent, with most estimates closer to 10 percent. Using the high end of the range, 20 percent, (as stated by Odum, 1970) for a conservative conversion factor and assuming that no intermediate steps occurred that could reduce the conversion efficiency, losses of game fish biomass were estimated (Table 8). Since Lepomis sp. is a game fish, losses were based on the average weight of an adult at MGT. It is clear that even using a conservative approach to calculating losses of potential game fish biomass, that losses were quite small and considerably less than would be expected from just a few days of recreational fishing in the Palatka, Florida area.

Due to the conservative nature of the model used, no compensatory response by the populations involved was assumed. The nature of the pertubation to the fish community actually differs from the model in that it has less impact on the fish population than the model predicts.

It is important in assessing the impact of intake operation on fish communities to understand the nature of their action on individual fish populations, which, as McFadden (1977) notes, is predatory:

> "...the imposition on a population of increased mortality that takes a form similar to natural predation...is the kind of impact to which the population has been adapted by thousands or millions of years of evolutionary experience. The agent of mortality--predatory fish, commercial or sport fishermen, or power plants--is an indifferent matter from the standpoint of population response. When the population is reduced in numbers, the survival rate or reproductive rate among the remaining members tends to increase; a compensating response is generated."

In addition, only young-of-the-year fish are vulnerable to the proposed intake.

The effect of removing young-of-the-year fish is discussed by McFadden (1977), who quotes Ricker (1954, p.607), as follows:

> "Exploitation that takes fish at an age when natural mortality is still compensatory means, for practical purposes, a fishery for young during the first year or two of their life--the earlier the better. The removal of such young is at least partly balanced by increased survival and/or growth of the remainder..."

Ricker goes on to say:

> "...that any general prejudice against exploiting of young fish is unsound."

The natural fecundity of the major species of fish found in the St. Johns River makes extremely high mortalities inevitable. Otherwise these species would rapidly increase in number.

The overall numbers of macroinvertebrates present, the small quantity of river water to be taken in by the plant, and the fact that these macroinvertebrates are not characteristic of rare or unusual habitats indicate that adverse impacts to these populations should be small.

The above information and background information in the EA allows one to conclude (in addressing USEPA [1977] decision criteria) the following:

-The ecological functioning of the unit is not impaired or reduced to the point that long-term stability at the pre-existing level is decreased. In fact, it is unlikely that any adverse effects of intake operation could even be discerned at that level.

-No significant reduction in optimum sustained yield to the sport or commercial fishery is expected. Losses of game fish as indicated by the "equivalent adult" model will be very small and may actually be compensated.

-No endangered species is adversely affected. No endangered fish species was found in the area and the stationary nature of the screens and low intake velocity eliminate the potential for adversely affecting aquatic mammals.

-The operation of the intake will not cause an unmitigatable loss to the aquatic system. Effects will be very small.

6.2 MITIGATION OF IMPACTS

It is quite clear from examination of Tables 4, 6, and 8 and from other information presented in section 5.0 (Results) that substantial reductions in entrainment can be achieved by use of cylindrical, fine-slot opening wedge-wire screens with a low approach velocity (less than 0.5 fps) and uniform velocity field. Estimated larval entrainment was reduced more than 60 percent by the 1 mm and 2 mm screens (as compared to the essentially unscreened intake).

It was also clear that almost complete mitigation of impingement impacts may be achieved in this same way. This cannot be overemphasized, since protection of older life stages from loss as a result of intake operation is of paramount importance. Older life stages have "more value" to their respective populations than younger life stages. Many fish species are extremely fecund. Many more eggs are produced than survive to become larvae. In turn, the number of larvae is much higher than the number surviving to become juveniles, and the number of juveniles is much higher than the number that survive to maturity.

The other features of intake location, plant capacity, and minimized dredging (EA, 1978), in addition to the above, indicate that the system chosen constitutes BTA.

7.0 CONCLUSIONS

After reviewing the available data, the results of the studies conducted, and the available literature, an intake has been selected that can mitigate impingement and entrainment impacts by:

1. Reducing the cooling water volume required
2. Placing the intake in an area of low fish density and outside the nearshore vegetation area
3. Using fine-opening screens to exclude even relatively small organisms
4. Having low approach velocities
5. Having a uniform velocity field
6. Locating the intake and the discharge in such a manner as to prevent the recirculation of discharged water

Other potential adverse impacts would be reduced by:

7. Reducing dredging especially in the nearshore zone

Potential adverse impacts that can be caused by intake operation have been analyzed, and it is concluded that:

1. The effect of the intake is predatory in nature.
2. The operation of the intake will not significantly reduce or impair the ecological functioning of the community.
3. There will be no significant reduction in yield of sport or commercial fish.
4. Endangered species will not be adversely affected.

8.0 BTA STATEMENT

A Plan of Study for the work necessary to assist USEPA to determine best technology available (BTA) was submitted to and approved by the USEPA (Region IV), the U.S. Fish and Wildlife Service, or USFWS (Region IV), the USFWS National Power Plant Team, the Florida Department of Environmental Regulation, and the Florida Game and Freshwater Fish Commission.

These studies, together with those in the EA (1979), fulfill compliance with Section 316(b) of the Clean Water Act, or CWA (P.L. 92-500 as amended in 1977) and criteria of the USEPA 316(b) Guidance Manual (1977). Section 316(b) of the CWA requires that the "...location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact."

With respect to these criteria, the following conclusions have been reached:

1. The location of the plant intake is offshore in an area of relatively low fish and ichthyoplankton densities. This location avoids beds of aquatic macrophytes and fish nursery areas.

2. The design of the intake incorporates screens with fine openings that have a low approach velocity (less than 0.5 fps maximum) and an extremely uniform velocity distribution. These screens greatly reduce impingement and entrainment of younger fish life stages and prevent impingement and entrainment of older fish by excluding them.

3. Dredging and construction impacts will be greatly reduced by the presence of relatively deep water at the offshore location and by the absence of productive macrophyte beds and associated communities.

4. Closed-cycle cooling will greatly reduce the capacity (cooling water withdrawal rate) for the proposed units.

Therefore the cooling water intake of proposed Seminole Plant Units No. 1 and No. 2 will meet Section 316(b) criteria for "...the best technology available for minimizing environmental impact."

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APPENDIX A

INTAKE LOCATION STUDY

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INTAKE LOCATION STUDY

METHODS

To assess the extent to which the proposed intake area was utilized by fish and to assess its use as a fish spawning area and nursery habitat, two tasks were performed: an investigation of submerged vegetation and sampling of fish from egg through adult stages. To sample fish from this broad a developmental range and from a variety of water depths, several different gear types were used. These included a minnow seine, an ichthyoplankton pump, a sled net, a towed ichthyoplankton net, gill nets, hoop nets, and an otter trawl. Sampling stations and techniques employed to conduct the two tasks are described below.

AQUATIC MACROPHYTES

On March 6, 1979, submerged macrophytes were mapped in the St. Johns River in the vicinity of Corridor A (defined in the EA). Five transect points were established: one at each edge of Seminole's property line within this corridor and three spaced equidistantly between these two points. On a line extending perpendicular to the shore at each of these points, macrophytes were sampled at 16.4 ft (5 cm) intervals. Sampling was conducted far enough into the river to determine the outside (riverward) edge of the bed at each transect. Macrophytes were collected by hand and with the use of a potato rake. Species composition of each sample was determined and notes on plant condition were made.

FISH AND MACROINVERTEBRATES

To assess fish and macroinvertebrate densities and the possible use of the proposed intake area for spawning and as a nursery area, it was necessary to sample fish as eggs, larvae, juveniles, and adults, as well as benthic macroinvertebrates and drift. It was also necessary to sample at depths ranging from several inches to approximately 10 ft (approximately 3 m). To accomplish this, a variety of gear were deployed; the use of each is described below.

Minnow Seine

On March 12, 1979, the St. Johns River was seined in the vicinity of Corridor A. A minnow seine allowed collection of juvenile and adult fishes in water up to 3 1/2 to 4 ft (1.1 to 1.2 m) deep. Seining stations were established at 20 ft (6.1 m), 25 ft (7.6 m), 50 ft (15.2 m), 100 ft (30.5 m), 150 ft (45.7 m), 200 ft (61.0 m), and 250 ft (76.2 m) intervals from shore. A 10 ft (3 m) minnow seine with a 1/8 in. (3.2 mm) Ace mesh was used. At the 20 ft (6.1 m) station, the seine was hauled from the station point to the river bank. At other stations, the seine was hauled parallel to shore; these hauls ranged from 50 ft (15.2 m) to 100 ft (30.5 m) in length.

Fish collected in the seine hauls were preserved in the field with 10 percent formalin (4 percent formaldehyde). Identification and measurements were performed in the laboratory. Keys used in identification included Hoese and Moore (1977), Stevenson (1976), and Pflieger (1975). Measurements of total length were made to the nearest millimeter.

Ichthyoplankton Pump

An ichthyoplankton pump was used to sample for organisms adhering to the substrate or present in the bottom several inches of the water column in the study area. Eggs of rainwater killifish, naked goby, and tidewater silverside (known to be abundant in the study area) are normally deposited on and adhere to substrate or aquatic vegetation (Hardy, 1978; Fritzche, 1978; Martin and Drewry, 1978). The ichthyoplankton pump allowed collection of these eggs and also the collection of fishes small enough to escape through the mesh of the minnow seine.

The ichthyoplankton pump acts much like a vacuum cleaner. A nozzle with a rectangular opening 9 in. (22.9 cm) by 20 in. (50.8 cm) was mounted on a sled. The nozzle was screened with a 3/4 in. (1.9 cm) diamond-shaped metal screen to exclude large debris which would clog the pump. This nozzle served as the intake for the system and was attached to a high volume (385 gpm), low pressure trash pump by a noncollapsible 3 in. (7.6 cm) diameter hose. The pump discharged through a canvas hose into a conical plankton net (363-micron mesh Nitex) with a sample bottle attached at the cod end.

A sample was taken by hand towing the sled and nozzle across the substrate for a distance of 50 ft (15.2 m). Tows were made parallel to shore at distances of 50 ft (15.2 m), 150 ft (45.7 m), and 250 ft (76.2 m) from the shoreline. The pump, powered by a four-cycle engine, was mounted on a boat. As the sled was towed across the substrate, loose sediment, debris, and vegetation were sucked through the nozzle and pump and discharged into the filter net. When a sample tow was completed, the debris retained in the net was washed down into the sample bottle. This sample was preserved in the field with 10 percent formalin (4 percent formaldehyde) and labelled appropriately. Duplicate samples were taken at each location.

Fish eggs and larvae were sorted from the debris in Dames & Moore's Cincinnati laboratory. Organisms were counted and identified. Several taxonomic references were used: Hardy (1978), Fritzche (1978), Martin and Drewry (1978), Wang and Kernehan (1979), and Stevenson (1976). Identifications were confirmed by Mr. D. Snyder at the Larval Fish Laboratory of Colorado State University, Fort Collins, Colorado.

River depth limited the area which could appropriately be sampled with this device. A minimum of 6 to 12 in. (15.2 to 30.5 cm) of water is required for complete submersion of the nozzle, which must be maintained for the pump to maintain suction. Beyond 250 ft (76.2 m) from shore, the river was too deep to tow the sled. Although the area that could be sampled with this device was limited, large volumes of soft substrate were filtered and yielded data that could not be obtained with any other method used in this survey.

Sled Net

A sled net (Wildlife Supply Co. [Wildco] Cat. No. 171) was used to sample water immediately above the river's substrate at stations located 150 ft (45.7 m), 250 ft (76.2 m), 350 ft (106.7 m), 500 ft (152.4 m), and 700 ft (213.4 m) from shore. This net, which is 14 in. (35.6 cm) wide by 14 in. (35.6 cm) high and supported on runners, rides close to the substrate as it is towed. 363-micron mesh Nitex was used as the netting material, and the net had a fitting at the cod end to allow the sample container to be attached directly to it.

The sled net was towed from the stern of an outboard-powered, open work boat. Tows were made parallel to shore for a duration of 4 minutes. Between 4.81 and 90.55 m^3 of water were filtered for each sample. The variation in sample volume was due to the net occasionally clogging with fine debris; this considerably reduced the filtering efficiency of the net. A General Oceanics model 2030 MK II digital flow meter was mounted in the net mouth. Readings from this meter allowed calculation of volume of sample. Samples were preserved in the field with 10 percent formalin (4 percent formaldehyde).

Duplicate tows, both day and night, were made at the 250 ft (76.2 m), 350 ft (106.7m), 500 (152.4 m), and 700 ft (213.4 m) stations. Only day tows were made at the 150 ft (45.7 m) station because the receding tide made this station too shallow to sample at night.

Use of the sled net allowed assessment of spatial and diel distributions of fish larvae and eggs present near the river bottom.

Ichthyoplankton Net

A towed conical ichthyoplankton net was used to sample the subsurface at distances 250 ft (76.2 m), 350 ft (106.7 m), 500 ft (152.4 m), and 700 ft (213.4 m) from shore. Both the subsurface and mid-depth were sampled at a distance of 900 ft (274.3 m) from shore. The conical plankton net, constructed of 363-micron mesh Nitex material, had a 75 cm (29.5 in.) mouth, a 3:1 length-to-mouth ratio, and was fitted with a cod end which accommodated a 1-liter sample jar. A General Oceanics Model 2030 MK II digital flow meter was suspended in the upper third of the net mouth. Readings from this meter allowed the calculation of volume of water filtered.

The net was deployed from the bow of the boat and towed at an effective velocity of approximately 0.90 m/sec (2.95 ft/sec) with the motor in reverse. A cable depressor (Wildco Cat. No. 090), suspended 5 to 6 1/2 ft (1.5 to 2.0 m) below the towing line about 6 1/2 feet (1.98 m) in front of the towing bridle, depressed the towing line and, consequently, the net. By adjusting the amount of towing line between the net and boat, the net's depth in the water column could be regulated. The length of line let out, and its angle of departure from the vertical was noted; this allowed calculation of net depth. Tows were made parallel to shore and upstream for 6 minutes; sample volumes were near 125 m^3. When a tow was completed, the contents of the net were washed into the sample bottle. The sample was preserved in the field with 10 percent formalin (4 percent formaldehyde) and the sample jar was labeled appropriately. Duplicate tows, both day and night, were made at each station.

The towed ichthyoplankton net allowed sampling of macroinvertebrate drift and macrozooplankton, eggs, larvae, juveniles, and some adults present in the mid and upper portions of the water column. Sampling closer to shore than 250 ft (76.2 m) could not be done with this net because of shallow water. In water less than about 6 ft (about 1.8 m) deep, the depressor would drag on the substrate and/or the net itself would dig into the substrate. Once this occurred, the debris in the net clogged the mesh and greatly impaired filtering efficiency.

Ekman Dredge

A 6" x 6" x 6" (152 mm x 152 mm x 152 mm) (Wildco Cat. No. 196) was utilized to collect benthic macroinvertebrates at various distances from shore. Triplicate samples were taken in the field at distances of 50 ft (15.2 m), 150 ft (45.7 m), 250 ft (76.2 m), 350 ft (106.7 m), 500 ft (152.4 m), 750 ft (213.4 m), and 900 ft (274.3 m) from shore. Samples were sieved in the field using a #30 sieve installed within a bucket (Wildco Cat. No. 190) and were preserved with 10 percent formalin (4 percent formaldehyde) and transported back to the laboratory for analysis.

Hoop Nets

Hoop nets were used to sample for adult fishes at stations 300 ft (91.4 m) and 900 ft (274.3 m) from shore. The front hoops of these nets were 3 ft (0.9 m) in diameter, and the nets were fitted with a mesh combination of 2 in. (5.1 cm) between the first three hoops and 1 1/2 in. (3.8 cm) between the remaining hoop. A 25 ft (7.6 m) lead of 2 in. (5.1 cm) mesh was attached to the front of the net. The nets were oriented perpendicular to shore and fished for 48 hours. They were checked every 12 hours and captured fishes were removed. Fish which could be identified with confidence were processed in the field; others were preserved in the field in 10 percent formalin (4 percent formaldehyde) and sent to the laboratory for processing. Total length (to the nearest mm), weight (to the nearest gm), and gonadal condition were recorded.

Gill Nets

Gill nets were used to sample for adult fishes at station 300 ft (91.4 m) and 900 ft (274.3 m) from shore. At the 300 ft (91.4 m) station, a net was fished at the bottom only. At the 900 ft (274.3 m) station, the net was set for 2 days on the bottom and then floated from the surface for 2 more days of fishing. Nets used were experimental monofilament gill nets consisting of 8 panels 9 ft (2.7 m) long by 4 ft (1.2 m) high. Each net contained one panel of 1/2 in. (1.3 cm) mesh, one of 1 in. (2.5 cm) mesh, one of 1 1/2 in. (3.8 cm) mesh, two of 2 in. (5.1 cm) mesh, one of 3 in. (7.6 cm) mesh, one of 3 1/2 in. (8.9 cm) mesh, and one of 4 in. (10.2 cm) mesh. Sets were made perpendicular to shore and fished for 2 days. Nets were checked and cleaned every 12 hours. Many fish in the nets had been partially consumed by crabs by the time the nets were cleaned. When possible, these fish were identified and measured. Other fish were processed in the field. Total length (to the nearest mm), weight (to the nearest gm), and gonadal condition were recorded.

Otter Trawl

A 10 ft (3.0 m) otter trawl (mouth height of 3 to 4 ft [0.9 to 1.2 m]) was used to sample for bottom-dwelling fishes at stations 300 ft (91.4 m) and 900 ft (274.3 m) from shore. The trawl was lined with a 1/4 in. (0.6 cm) mesh line to retain juvenile fishes. Duplicate tows were made parallel to shore at each station both day and night. Adult fish were processed in the field. Smaller fish were preserved in the field in 10 percent formalin (4 percent formaldehyde) and transported to the laboratory for processing. Measurements of total length (to the nearest mm) were made on all fish. For adult fish, weight measurements (to the nearest gm) were taken and gonadal condition checked.

RESULTS

INTRODUCTION

The previously described sampling program was designed to provide data with which an environmentally suitable intake location could be chosen.

AQUATIC MACROPHYTES

Vallisneria beds or areas capable of supporting *Vallisneria* are considered to be fish spawning and nursery grounds by the state of Florida (Murrin, 1979). A survey conducted by the U.S. National Marine Fisheries Services at the possible inshore intake location concluded that the vegetation in that area provided habitat suitable as nursery areas for finfish and shellfish species (Stevenson, 1979).

As previously described, a survey to map the aquatic macrophytes in the St. Johns River at Corridor A was conducted on March 6, 1979. The following results were obtained on the basis of this survey:

1. *Vallisneria* is the dominant vegetation in the area and extends as a wide band from approximately 16 ft (approximately 5 m) from the bank to approximately 180 to 230 ft (approximately 55 to 70 m) offshore.

2. The riverward edge of the bed is determined by river depth. In the St. Johns River, light penetration adequate for *Vallisneria* growth is not sufficient in water deeper than 4 to 5 ft (1.2 to 1.5 m).

3. Near shore, *Vallisneria* generally consists of young, short plants. This suggests new growth in an area where wave action is eroding away plants at a fairly constant rate.

4. Mature, long-leaved, and dense growths of *Vallisneria* occurred from approximately 100 ft (approximately 30 m) to 150 to 165 ft (45 to 50 m) offshore.

5. Beyond 165 ft (50.3 m), most Vallisneria were ragged, mature plants with most of the leaves broken off. This may be due to wave and/or current action in this zone.

6. No Hydrilla was found. Only one significant patch of Eleocharis was found, and this was near shore.

7. Highest densities of Naja occurred in areas with little or no Vallisneria and usually closer to shore than Vallisneria.

The presence of this macrophyte bed does establish the potential for a nursery area in the near shore zone of Corridor A. The extent to which this area was actually being utilized by fishes was then surveyed. The results of this subsequent survey are described in the following section.

FISHES

To assess fish distribution and the extent to which they might utilize the macrophyte bed within Corridor A, fishes were sampled at variously spaced stations out to a distance of 900 ft (274.3 m) from shore with seven different gear types. The station locations and gear were previously described. The variety of gear allowed collection of fish from eggs through adults at river depths from several inches to approximately 10 ft (3 m). The sampled area included the macrophyte bed, the site for the proposed intake, and the site for the proposed discharge. The results by gear type of this survey are described in the following subsections.

Seines

Seine hauling results (Table A-1) indicated that fish were concentrated in two areas: within 20 ft (6.1 m) of the shoreline and at a distance of approximately 50 ft (15.2 m) from shore. In both cases, adult mosquitofish (Gambusia affinis) were the most abundant species collected. Rainwater killifish (Lucania parva) and tidewater silverside (Menidia beryllina) were also abundant. Numbers of fish and numbers of species both declined beyond 50 ft from shore. Beyond the macrophyte bed (at the 200 and 250 ft [70.0 m and 76.2 m] stations), numbers were much reduced, with only one and four fish, respectively, collected at the two stations.

Small fish seem to concentrate in the inshore portions of moderate to dense cover afforded by the macrophyte bed present within Corridor A. Beyond this bed, small fish abundance was considerably reduced.

Ichthyoplankton Pump

Results of ichthyoplankton pump sampling are presented in Table A-2. Numbers of fish and eggs were similar at the 50 ft (15.2 m) and 150 ft (45.7 m) stations and considerably reduced at the 250 ft (76.2 m) station. Sampling nearest the shore (50 ft station) yielded more species (4) than did that offshore (1 species at 150 feet; 2 species at 250 feet).

Results of ichthyoplankton pump sampling confirm results from seine hauls: fish were concentrated in the macrophyte areas. Pump data also show that fish eggs are most abundant in these same areas.

Sled Net

Sled net data (Table A-3) show a distinct difference between day and night captures. Fish or eggs were found in only one out of 10 day tows as opposed to 6 out of 12 night tows. Eggs appeared in one tow, a night tow 150 ft (45.7 m) from shore. Juvenile fish showed an irregular distribution up to 500 ft (152.4 m) from shore. No fish were captured at the 700 ft (213.4 m) and 900 ft (274.3 m) stations.

These results generally confirm those found using other methods. Eggs were found in the area occupied by the macrophyte bed. Few fish were found beyond the bed, and those that were found--Atlantic croaker (Micropogan undulatus) and hogchoker (Trinectes maculatus)--were not the same species found abundantly among macrophytes by seining or ichthyoplankton pump.

Ichthyoplankton Net

Ichthyoplankton net data (Table A-4) also showed distinct differences between frequencies of day and night captures. Fish were captured in one out of 12 day tows compared to all 12 night tows. This may reflect actual diel differences in abundance in this area; however, it is felt that this more likely reflects net avoidance by fish during the day.

Fish eggs were collected in only one tow, a night tow 250 ft (76.2 m) from shore. This tow passed through the outer margin of the macrophyte bed, which probably explains the appearance of eggs in this sample. Other tows--all made beyond the macrophyte bed--did not collect any eggs.

Although total densities of fish collected were fairly even in night tows made from 250 ft (76.2 m) to 900 ft (274.3 m) from shore, the species composition of fish collected at 350 ft (106.7 m) and beyond did show some differences from samples collected closer to shore with other techniques. Whereas killifish, sailfin mollies, silversides, and gobies were abundant in seine haul samples taken over the macrophyte bed, only silversides (of these four) were collected by the ichthyoplankton net. The larvae and juveniles of Atlantic croaker and bay anchovy appeared frequently in ichthyoplankton net tows but not at all in seine hauls.

Gill Nets and Hoop Nets

Only one fish was captured with the hoop nets (Table A-5). This was a female redear sunfish (Lepomis microlophus) captured from a net set 900 ft (274.3 m) offshore.

Gill net captures (Table A-6) did not show any conclusive differences between sets placed 300 ft (91.4 m) and 900 ft (274.3 m) from shore. Clupeid species--blueback herring (Alosa aestivalis), gizzard shad (Dorosoma cepedianum), and threadfin shad (D. petenense)--were those most frequently captured. Other species captured included bluegill (Lepomis macrochirus) and white catfish (Ictalurus catus).

Otter Trawl

Among fishes collected in the otter trawl (Table A-7), Atlantic croaker was most abundant, followed by white catfish and bay anchovy. All the croakers collected were juveniles or late postlarvae. Most white catfish were juveniles, and all anchovies were adults. Overall, croaker and white catfish were more abundant at the station 900 ft (274.3 m) from shore, while anchovies were more abundant at the station 300 ft (91.4 m) from shore.

The abundance of young croakers and white catfish in these collections contrasts to the absence of these species from collections made over the macrophyte bed. Areas offshore and free from vegetation apparently are important to juvenile croakers and white catfish. Croakers and white catfish were actually more abundant at the distant station (900 ft [274.3 m] from shore) than at the closer station (300 ft [91.4 m] from shore).

MACROINVERTEBRATES

Macroinvertebrates collected appear in Tables A-8 and A-9. The numerically dominant taxa were tubificid worms (47 percent), chironomid midges (37 percent), isopods (6 percent), and amphipods (3 percent). The tubificids and chironomids apparently reach their peak abundances and diversities at about 350 ft (106.7 m) from shore. Both of these taxa are widely distributed and relatively abundant along the 900-foot transect. Both taxa are very resilient, i.e. they recover rapidly from major population shifts. Chironomids disperse through a flying adult stage. Dispersal of tubificids larvae would be greatly enhanced by local currents. Thus, recolonization would not be difficult for these organisms.

Among other minor taxa observed, only the blue crab, Callinectes sapidus, is of significant commercial interest. Its rare occurrence in the samples probably reflects its ability to avoid plankton nets, in addition to its relatively low density. Adult and juvenile blue crabs should not be adversely affected by the intake. Larval Callinectes would be entrained, but blue crabs would not reproduce significantly at such low salinities and would not be found in the area. Adult and juvenile blue crabs may be attracted by impinged or fouled food sources on the screens.

The relative abundance of drift organisms (those macroinvertebrates found among the zooplankton) at the various distances from shore show a reduction in density with distance from shore, particularly at night. Most organisms found were rather common at all locations and most would be considered mobile and widespread.

CONCLUSION

The data from these studies confirm the presence of a macrophyte bed extending approximately 16 ft (5 m) to approximately 180 to 230 ft (50 to 70 m) from shore. Data from fish collections suggest that this bed is utilized by some small forage species as a spawning ground and nursery area. Species for which this area appears particularly important include rainwater killifish, mosquitofish, sailfin molly, tidewater silverside, and naked goby. These species did not appear in any abundance in samples taken beyond the macrophyte bed. Otter trawl data suggest that vegetation-free offshore areas are utilized by juvenile and adult white catfish and juvenile Atlantic croakers. These species were more abundant as juveniles at the 900 ft (274.3 m) station than at the 300 ft (91.4 m) station.

TABLE A-1

INSHORE SAMPLING AREA
SEINE SAMPLING (10 ft SEINE)

MARCH 12, 1979

Species Scientific Name Common Name	Life Stage	Location - 20 ft				Location - 25 ft				Location - 50 ft				Location - 100 ft				Location - 150 ft				Location - 200 ft				Location - 250 ft			
		Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.	Distance Seined (ft)	Number Collected	Size Range (mm) Min.	Max.
Notemigonus crysoleucas Golden shiner	Adult					50	1	-	145																				
	Juvenile																												
	Larvae																												
Fundulus confluentus Marsh killifish	Adult	20	1																										
	Juvenile																												
	Larvae																												
Fundulus seminolis Seminole killifish	Adult	20	32							50	51			100	1	-	76												
	Juvenile	20	28																										
	Larvae																												
Lucania goodei Bluefin killifish	Adult	20	1																										
	Juvenile																												
	Larvae																												
Lucania parva Rainwater killifish	Adult	20	193							50	93																		
	Juvenile																												
	Larvae																												
Gambusia affinis Mosquitofish	Adult	20	239							50	522																		
	Juvenile																												
	Larvae																												
Heterandria formosa Least killifish	Adult	20	1																										
	Juvenile																												
	Larvae																												
Poecilia latipinna Sailfin molly	Adult	20	33							50	4	20	50																
	Juvenile																												
	Larvae																												
Menidia beryllina Tidewater silverside	Adult	20	37							50	238			100	10	35	56	50	2	46	51	50	1	40	45				
	Juvenile																									50	1	40	45
	Larvae																												
Lepomis macrochirus Bluegill	Adult													100	2	90	99	50	1	-	101								
	Juvenile	20	4			50	5	25	76	50	3	30	68	100	8	30	74	50	2	51	67					50	1	-	78
	Larvae																												
Lepomis microlophus Redear sunfish	Adult																												
	Juvenile	20	2																										
	Larvae																												
Mugil cephalus Striped mullet	Adult									50	4	20	40																
	Juvenile																												
	Larvae																												
Gobiosoma bosci Naked goby	Adult	20	6							50	22			100	33	20	35												
	Juvenile					50	7	20	35									50	11	20	30					50	1	20	25
	Larvae																												
Microgobius gulosus Clown goby	Adult																												
	Juvenile																									50	1	30	35
	Larvae																												
TOTALS			577				13				937				54				16				1				4		

TABLE A-2

ICHTHYOPLANKTON PUMP SAMPLES
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
50 FEET (15.2 M) FROM SHORE[a]
MARCH 9, 1979

		Replicate A				Replicate B				Replicate C			
Taxon	Life Stage	No. of Individuals	Min (mm)	Mode (mm)	Max (mm)	No. of Individuals	Min (mm)	Mode (mm)	Max (mm)	No. of Individuals	Min (mm)	Mode (mm)	Max (mm)
Lucania parva	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Rainwater killifish	Juvenile	3	20-25	20-25	25-30	4	25-30	25-30	35-40	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Gambusia affinis	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Mosquitofish	Juvenile	-	-	-	-	-	-	-	-	2	-	20-25	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Menidia beryllina	Adult	1	-	40-45	-	-	-	-	-	-	-	-	-
Tidewater silverside	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Naked goby	Juvenile	1	-	20-25	-	2	15-20	-	20-25	1	-	15-20	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Eggs		14	-	-	-	3	-	-	-	9	-	-	-
	Totals	19				9				12			

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[a] Numbers are for one standard transect of 150 ft (45.72 m) length

TABLE A-2 (Continued)

ICHTHYOPLANKTON PUMP SAMPLES
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
150 FEET (45.7 M) FROM SHORE[a]
MARCH 9, 1979

		Replicate A				Replicate B			
Taxon	Life Stage	No. of Individuals	Min (mm)	Mode (mm)	Max (mm)	No. of Individuals	Min (mm)	Mode (mm)	Max (mm)
Lucania parva	Adult	-	-	-	-	-	-	-	-
Rainwater killifish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Gambusia affinis	Adult	-	-	-	-	-	-	-	-
Mosquitofish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Menidia beryllina	Adult	-	-	-	-	-	-	-	-
Tidewater silverside	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-
Naked goby	Juvenile	2	-	20-25	-	7	15-20	20-25	20-25
	Larvae	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	1	-	25-30	-
	Larvae	-	-	-	-	-	-	-	-
Eggs		16	-	-	-	7	-	-	-
	Totals	18				15			

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[a] Numbers are for one standard transect of 150 ft (45.72 m) length

TABLE A-2 (Continued)

ICHTHYOPLANKTON PUMP SAMPLES
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
250 FEET (76.2 M) FROM SHORE[a]
MARCH 9, 1979

Taxon	Life Stage	Replicate A No. of Individuals	Replicate A Min (mm)	Replicate A Mode (mm)	Replicate A Max (mm)	Replicate B No. of Individuals	Replicate B Min (mm)	Replicate B Mode (mm)	Replicate B Max (mm)
Lucania parva	Adult	-	-	-	-	-	-	-	-
Rainwater killifish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Gambusia affinis	Adult	-	-	-	-	-	-	-	-
Mosquitofish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Menidia beryllina	Adult	-	-	-	-	-	-	-	-
Tidewater silverside	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-
Naked goby	Juvenile	-	-	-	-	2	15-20	-	20-25
	Larvae	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	1	-	30-35	-
	Larvae	-	-	-	-	-	-	-	-
Eggs		1	-	-	-	3	-	-	-
	Totals	1				6			

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[a] Numbers are for one standard transect of 150 ft (45.72 m) length

TABLE A-3

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
150 FEET (45.7 M) FROM SHORE
NIGHT, MARCH 9, 1979

		Replicate A				Replicate B			
		Volume Sampled: 41.69 m^3				Volume Sampled: 72.29 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult	-	-	-	-	-	-	-	-
Bluegill	Juvenile	-	-	-	-	1.38	-	30-35	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-
Naked goby	Juvenile	-	-	-	-	2.77	-	20-25	-
	Larvae	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Trinectes maculatus	Adult	-	-	-	-	-	-	-	-
Hogchoker	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Eggs		2.40	-	-	-	-	-	-	-
	Totals	2.40				4.15			

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
250 FEET (76.2 M) FROM SHORE
NIGHT, MARCH 9, 1979

Taxon	Life Stage	Replicate A				Replicate B			
		Volume Sampled: 14.23 m^3				Volume Sampled: 12.63 m^3			
		No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus Bluegill	Adult								
	Juvenile								
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								
Gobiosoma bosci Naked goby	Adult								
	Juvenile				NONE CAPTURED				
	Larvae								
Microgobius gulosus Clown goby	Adult								
	Juvenile								
	Larvae								
Trinectes maculatus Hogchoker	Adult								
	Juvenile								
	Larvae								

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
350 FEET (106.7 M) FROM SHORE
DAY, MARCH 12, 1979

Taxon	Life Stage	Replicate A				Replicate B			
		Volume Sampled: 43.21 m^3				Volume Sampled: 47.72 m^3			
		No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult								
Bluegill	Juvenile								
	Larvae								
Micropogon undulatus	Adult								
Atlantic croaker	Juvenile								
	Larvae								
Gobiosoma bosci	Adult								
Naked goby	Juvenile				NONE CAPTURED				
	Larvae								
Microgobius gulosus	Adult								
Clown goby	Juvenile								
	Larvae								
Trinectes maculatus	Adult								
Hogchoker	Juvenile								
	Larvae								

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
350 FEET (106.7 M) FROM SHORE
NIGHT, MARCH 9, 1979

		Replicate A				Replicate B			
		Volume Sampled: 69.43 m^3				Volume Sampled: 62.74 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult	-	-	-	-	-	-	-	-
Bluegill	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	2.88	25-30	-	30-35	3.19	40-45	-	45-50
	Larvae	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-
Naked goby	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Trinectes maculatus	Adult	-	-	-	-	-	-	-	-
Hogchoker	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
	Totals	2.88				3.19			

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
500 FEET (152.4) FROM SHORE
DAY, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 37.74 m^3				Volume Sampled: 37.70 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus Bluegill	Adult	NONE CAPTURED							
	Juvenile								
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								
Gobiosoma bosci Naked goby	Adult								
	Juvenile								
	Larvae								
Microgobius gulosus Clown goby	Adult								
	Juvenile								
	Larvae								
Trinectes maculatus Hogchoker	Adult								
	Juvenile								
	Larvae								

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
500 FEET (152.4 M) FROM SHORE
NIGHT, MARCH 9, 1979

		Replicate A				Replicate B			
		Volume Sampled: 15.21 m^3				Volume Sampled: 54.76 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult	-	-	-	-	-	-	-	-
Bluegill	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	-	-	-	-	1.83	-	35-40	-
	Larvae	-	-	-	-	-	-	-	-
Gobiosoma bosci	Adult	-	-	-	-	-	-	-	-
Naked goby	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	-	-
Clown goby	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Trinectes maculatus	Adult	-	-	-	-	-	-	-	-
Hogchoker	Juvenile	-	-	-	-	6.57	-	30-35	-
	Larvae	-	-	-	-	-	-	-	-
	Totals	0.00				8.40			

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
700 FEET (213.4 M) FROM SHORE
DAY, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 23.29 m^3				Volume Sampled: 90.55 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult	NONE CAPTURED							
Bluegill	Juvenile								
	Larvae								
Micropogon undulatus	Adult								
Atlantic croaker	Juvenile								
	Larvae								
Gobiosoma bosci	Adult								
Naked goby	Juvenile								
	Larvae								
Microgobius gulosus	Adult								
Clown goby	Juvenile								
	Larvae								
Trinectes maculatus	Adult								
Hogchoker	Juvenile								
	Larvae								

TABLE A-3 (Continued)
ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
700 FEET (213.4 M) FROM SHORE
NIGHT, MARCH 9, 1979

		Replicate A				Replicate B			
		Volume Sampled: 11.61 m^3				Volume Sampled: 4.81 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus	Adult								
Bluegill	Juvenile								
	Larvae								
Micropogon undulatus	Adult								
Atlantic croaker	Juvenile								
	Larvae								
Gobiosoma bosci	Adult								
Naked goby	Juvenile				NONE CAPTURED				
	Larvae								
Microgobius gulosus	Adult								
Clown goby	Juvenile								
	Larvae								
Trinectes maculatus	Adult								
Hogchoker	Juvenile								
	Larvae								

TABLE A-3 (Continued)
ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
900 FEET (274.3 M) FROM SHORE
DAY, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 13.40 m^3				Volume Sampled: 16.21 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus Bluegill	Adult								
	Juvenile								
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								
Gobiosoma bosci Naked goby	Adult								
	Juvenile	NONE CAPTURED							
	Larvae								
Microgobius gulosus Clown goby	Adult								
	Juvenile								
	Larvae								
Trinectes maculatus Hogchoker	Adult								
	Juvenile								
	Larvae								

TABLE A-3 (Continued)

ICHTHYOPLANKTON SLED NET
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
900 FEET (274.3 M) FROM SHORE
NIGHT, MARCH 9, 1979

		Replicate A				Replicate B			
		Volume Sampled: 45.13 m^3				Volume Sampled: 38.82 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Lepomis macrochirus Bluegill	Adult								
	Juvenile								
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								
Gobiosoma bosci Naked goby	Adult								
	Juvenile								
	Larvae								
Microgobius gulosus Clown goby	Adult								
	Juvenile								
	Larvae								
Trinectes maculatus Hogchoker	Adult								
	Juvenile								
	Larvae								

NONE CAPTURED

TABLE A-4

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A

250 FEET (76.2 M) FROM SHORE
DAY, MARCH 11, 1979

		Replicate A				Replicate B			
		Volume Sampled: 122.83 m^3				Volume Sampled: 103.65 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata American eel	Adult								
	Juvenile								
	Larvae								
Dorosoma cepedianum Gizzard shad	Adult								
	Juvenile								
	Larvae								
Anchoa mitchilli Bay anchovy	Adult								
	Juvenile				NONE CAPTURED				
	Larvae								
Lucania parva Rainwater killifish	Adult								
	Juvenile								
	Larvae								
Menidia beryllina Tidewater silverside	Adult								
	Juvenile								
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								
	Totals								

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
350 FEET (106.7 M) FROM SHORE
DAY, MARCH 11, 1979

		Replicate A				Replicate B			
		Volume Sampled: 86.08 m^3				Volume Sampled: 91.28 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata	Adult								
American eel	Juvenile								
	Larvae								
Dorosoma cepedianum	Adult								
Gizzard shad	Juvenile								
	Larvae								
Anchoa mitchilli	Adult								
Bay anchovy	Juvenile								
	Larvae								
Lucania parva	Adult								
Rainwater killifish	Juvenile								
	Larvae								
Menidia beryllina	Adult								
Tidewater silverside	Juvenile								
	Larvae								
Micropogon undulatus	Adult								
Atlantic croaker	Juvenile								
	Larvae								
	Totals								

NONE CAPTURED

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
350 FEET (106.7 M) FROM SHORE
NIGHT, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 140.91 m^3				Volume Sampled: 132.03 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata	Adult	-	-	-	-	-	-	-	-
American eel	Juvenile	3.55	52	-	59	0.76	-	52	-
	Larvae	-	-	-	-	-	-	-	-
Dorosoma cepedianum	Adult	-	-	-	-	-	-	-	-
Gizzard shad	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Anchoa mitchilli	Adult	-	-	-	-	-	-	-	-
Bay anchovy	Juvenile	-	-	-	-	-	-	-	-
	Larvae	2.13	-	20-25	-	-	-	-	-
Lucania parva	Adult	-	-	-	-	-	-	-	-
Rainwater killifish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Menidia beryllina	Adult	-	-	-	-	-	-	-	-
Tidewater silverside	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	-	-	-	-	3.03	20-25	-	25-30
	Larvae	2.84	-	20-25	-	-	-	-	-
	Totals	8.52				3.79			

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A

500 FEET (152.4 M) FROM SHORE
DAY, MARCH 11, 1979

		Replicate A				Replicate B			
		Volume Sampled: 98.38 m^3				Volume Sampled: 95.15 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata American eel	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Dorosoma cepedianum Gizzard shad	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Anchoa mitchilli Bay anchovy	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Lucania parva Rainwater killifish	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Menidia beryllina Tidewater silverside	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus Atlantic croaker	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	1.05	-	25-30	-
	Larvae	-	-	-	-	-	-	-	-
	Totals	0.00				1.05			

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
500 FEET (152.4 M) FROM SHORE
NIGHT, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 133.35 m^3				Volume Sampled: 140.29 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata	Adult	-	-	-	-	-	-	-	-
American eel	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Dorosoma cepedianum	Adult	-	-	-	-	-	-	-	-
Gizzard shad	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Anchoa mitchilli	Adult	0.75	-	40-45	-	-	-	-	-
Bay anchovy	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Lucania parva	Adult	-	-	-	-	-	-	-	-
Rainwater killifish	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Menidia beryllina	Adult	-	-	-	-	-	-	-	-
Tidewater silverside	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	0.71	-	<5	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	-	-	-	-	-	-	-	-
	Larvae	2.25	20-25	20-25	25-30	0.71	-	20-25	-
	Totals	3.00				1.42			

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
700 FEET (213.4 M) FROM SHORE
DAY, MARCH 11, 1979

		Replicate A				Replicate B			
		Volume Sampled: 96.48 m^3				Volume Sampled: 100.15 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Anguilla rostrata	**Adult**								
American eel	**Juvenile**								
	Larvae								
Dorosoma cepedianum	**Adult**								
Gizzard shad	**Juvenile**								
	Larvae								
Anchoa mitchilli	**Adult**								
Bay anchovy	**Juvenile**				NONE CAPTURED				
	Larvae								
Lucania parva	**Adult**								
Rainwater killifish	**Juvenile**								
	Larvae								
Menidia beryllina	**Adult**								
Tidewater silverside	**Juvenile**								
	Larvae								
Micropogon undulatus	**Adult**								
Atlantic croaker	**Juvenile**								
	Larvae								
	Totals								

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
700 FEET (213.4 M) FROM SHORE
NIGHT, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 127.85 m^3				Volume Sampled: 126.79 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Brevoortia tyrannus Atlantic menhaden	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	0.79	-	25-30	-
Anchoa mitchilli Bay anchovy	Adult	-	-	-	-	1.58	35-40	-	67
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus Atlantic croaker	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	2.35	-	20-25	-	3.94	20-25	25-30	25-30
	Totals	2.35				6.31			

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
900 FEET (274.3 M) FROM SHORE (SURFACE)
NIGHT, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 140.57 m^3				Volume Sampled: 135.13^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Brevoortia tyrannus	Adult	-	-	-	-	-	-	-	-
Atlantic menhaden	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Anchoa mitchilli	Adult	2.13	40-45	40-45	45-40	1.48	40-45	-	56
Bay anchovy	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	-	-	-	-	-	-	-	-
	Larvae	1.42	20-25	-	25-30	2.22	15-20	-	25-30
	Totals	3.55				3.70			

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
900 FEET (274.3 m) FROM SHORE (MID-DEPTH)
DAY, MARCH 11, 1979

		Replicate A				Replicate B			
		Volume Sampled:				Volume Sampled:			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Brevoortia tyrannus Atlantic menhaden	Adult								
	Juvenile								
	Larvae								
Anchoa mitchilli Bay anchovy	Adult								
	Juvenile				NONE CAPTURED				
	Larvae								
Micropogon undulatus Atlantic croaker	Adult								
	Juvenile								
	Larvae								

TABLE A-4 (Continued)

ICHTHYOPLANKTON NET TOWS
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
900 FEET (274.3 M) FROM SHORE (MID-DEPTH)
NIGHT, MARCH 12, 1979

		Replicate A				Replicate B			
		Volume Sampled: 134.98 m^3				Volume Sampled: 124.44 m^3			
Taxon	Life Stage	No./100m^3	Min (mm)	Mode (mm)	Max (mm)	No./100m^3	Min (mm)	Mode (mm)	Max (mm)
Brevoortia tyrannus Atlantic menhaden	Adult	-	-	-	-	-	-	-	-
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	0.80	-	25-30	-
Anchoa mitchilli Bay anchovy	Adult	-	-	-	-	2.41	35-40	35-40	53
	Juvenile	-	-	-	-	-	-	-	-
	Larvae	3.70	30-35	30-35	40-45	-	-	-	-
Micropogon undulatus Atlantic croaker	Adult	-	-	-	-	-	-	-	-
	Juvenile	2.22	-	25-30	-	-	-	-	-
	Larvae	-	-	-	-	0.80	-	30-35	-
	Totals	5.92				4.01			

TABLE A-5

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A

HOOP NET [a], 300 FEET (91.4 m) FROM SHORE
DAY, MARCH 31, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

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[a] Soak time: 12 hours

TABLE A-5 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A

HOOP NET [a], 900 FEET (274.3 m) FROM SHORE
DAY, MARCH 31, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-5 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
HOOP NET[a] 300 FEET (91.4 m) FROM SHORE
DAY, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-5 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
HOOP NET [a], 300 FEET (91.4 m) FROM SHORE
NIGHT, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-5 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
HOOP NET[a], 900 FEET (274.3 m) FROM SHORE
DAY, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-5 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
HOOP NET[a,b], 900 FEET (274.3 M) FROM SHORE
NIGHT, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	-	-	-	-
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	221	207	Female	Adult, II[c]
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

[b] All other hoop net sampling yielded no fishes

[c] Classification of sexual condition after Nikolsky, 1963

TABLE A-5 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
HOOP NET[a], 300 FEET (91.4 m) FROM SHORE
NIGHT, APRIL 2, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-5 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A

HOOP NET[a], 900 FEET (274.3 m) FROM SHORE
NIGHT, APRIL 2, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-5 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-6

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
SURFACE GILL NET[a], 900 FEET (274.3 M) FROM SHORE
NIGHT, MARCH 31, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	334 371	340 495	Unknown Female	Unknown Adult, II[b]
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
SURFACE GILL NET[a], 900 FEET (274.3 M) FROM SHORE
DAY, APRIL 2, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	–	–	–	–
Alosa aestivalis Blueback herring	–	–	–	–
Dorosoma cepedianum Gizzard shad	–	–	–	–
Dorosoma petenense Threadfin shad	–	–	–	–
Ictalurus catus White catfish	–	–	–	–
Lepomis macrochirus Bluegill	b	–	–	–
Lepomis microlophus Redear sunfish		–	–	–
Aplodinotus grunniens Freshwater drum	–	–	–	–

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Head of one crab-eaten *Lepomis* (?) found in net

TABLE A-6 (continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
SURFACE GILL NET[a], 900 FEET (274.3 M) FROM SHORE
DAY, APRIL 3, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	-	-	-	-
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	250[b]	322	Male	Adult, II[c]
Lepomis macrochirus Bluegill	165[b]	211	Female	Adult, II
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	105	10	-	Juvenile, I
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Tail eaten

[c] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
SURFACE GILL NET[b], 900 FEET (274.3 M) FROM SHORE
NIGHT, APRIL 3, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

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[a] Soak time: 12 hours

TABLE A-6
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 300 FEET (91.4 M) FROM SHORE
NIGHT, MARCH 31, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	177	48	-	Juvenile (I)[b]
	352	430	Female	Adult, II
	411	995	Female	Adult, II
Dorosoma petenense Threadfin shad	74	3	-	Juvenile (I)
	82	5	-	Juvenile (I)
	83	4	-	Juvenile (I)
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	112	15	-	Juvenile (I)

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 900 FEET (274.3 M) FROM SHORE
NIGHT, MARCH 31, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	334 371	340 495	Unknown Female	Unknown Adult, II[b]
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 300 FEET (91.4 M) FROM SHORE
DAY, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	87	4	-	Juvenile (I)[b]
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	286	328	Female	Adult, II
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	348	488	Female	Adult, III-IV

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 300 FEET (91.4 M) FROM SHORE
NIGHT, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis	171	48	Male	Adult, II[b]
Blueback herring	192	90	Male	Adult, II[b]
Dorosoma cepedianum	396	668	Female	Adult, II
Gizzard shad	409	860	Female	Adult, II
	423	876	Male	Adult, II
Dorosoma petenense[c]	93	8	-	-
Threadfin shad	94	9	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	239	318	Female	Adult, III
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus[d] Striped mullet	238	122	Male	Adult, II
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

[c] One threadfin shad lost while collecting net

[d] Two striped mullet lost while collecting net

TABLE A-6 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 900 FEET (274.3 M) FROM SHORE
DAY, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	382	725	Female	Adult, III[b]
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 900 FEET (274.3 M) FROM SHORE
NIGHT, APRIL 1, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	333	410	Male	Adult, II[b]
	~340	c	c	c
	341	458	Female	Adult, II
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	284	304	Female	Adult, II
Lepomis macrochirus Bluegill	186	118	Male	Juvenile (I)
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

[c] Eaten by crabs

TABLE A-6 (Continued)
ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 900 FEET (274.3 M) FROM SHORE
NIGHT, APRIL 2, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar				
Alosa aestivalis Blueback herring				
Dorosoma cepedianum Gizzard shad				
Dorosoma petenense Threadfin shad		NONE CAPTURED		
Ictalurus catus White catfish				
Lepomis macrochirus Bluegill				
Lepomis microlophus Redear sunfish				
Aplodinotus grunniens Freshwater drum				

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker				
Mugil cephalus Striped mullet				
Paralichthys lethostigma Southern flounder				

---

[a] Soak time: 12 hours

TABLE A-6 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 300 FEET (91.4 M) FROM SHORE
NIGHT, APRIL 2, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	578	b	b	b
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	338	374	Female	Adult, III[c]
	389	730	Female	Adult, II
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	-	-	-	-
Mugil cephalus Striped mullet	-	-	-	-
Paralichthys lethostigma Southern flounder	-	-	-	-

---

[a] Soak time: 12 hours

[b] Eaten: not able to determine

[c] Classification of sexual condition after Nikolsky, 1963

TABLE A-6 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
BOTTOM GILL NET[a], 900 FEET (274.3 M) FROM SHORE
NIGHT, APRIL 4, 1979

Species	Length (mm)	Weight (gm)	Sex	Condition
Lepisosteus osseus Longnose gar	-	-	-	-
Alosa aestivalis Blueback herring	-	-	-	-
Dorosoma cepedianum Gizzard shad	410 440	887 933	Female Female	Adult, III[b] Adult, Early III
Dorosoma petenense Threadfin shad	-	-	-	-
Ictalurus catus White catfish	-	-	-	-
Lepomis macrochirus Bluegill	-	-	-	-
Lepomis microlophus Redear sunfish	-	-	-	-
Aplodinotus grunniens Freshwater drum	-	-	-	-

TABLE A-6 (Continued)

Species	Length (mm)	Weight (gm)	Sex	Condition
Micropogon undulatus Atlantic croaker	–	–	–	–
Mugil cephalus Striped mullet	–	–	–	–
Paralichthys lethostigma Southern flounder	–	–	–	–

---

[a] Soak time: 12 hours

[b] Classification of sexual condition after Nikolsky, 1963

TABLE A-7

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
OTTER TRAWL, 300 FEET (91.4 M) FROM SHORE
APRIL 4, 1979

Taxon	Life Stage	DAY (0630)						NIGHT (1920)					
		TOW C			TOW D			TOW C			TOW D		
		# Collected	Size Range (mm)		# Collected	Size Range (mm)		# Collected	Size Range (mm)		# Collected	Size Range (mm)	
			Min	Max		Min	Max		Min	Max		Min	Max
Dorosoma petenense	Adult	1	-	93	1	-	153	-	-	-	-	-	-
Threadfin shad	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Anchoa mitchilli	Adult	2	52	56	43	44	66	-	-	-	-	-	-
Bay anchovy	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus catus	Adult	-	-	-	-	-	-	4	150	307	-	-	-
White catfish	Juvenile	-	-	-	2	78	88	2	88	106	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus nebulosus	Adult	-	-	-	-	-	-	-	-	-	1	-	196
Brown bullhead	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus punctatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	Juvenile	-	-	-	-	-	-	1	-	160	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Lepomis macrochirus	Adult	-	-	-	1	-	210	-	-	-	-	-	-
Bluegill	Juvenile	-	-	-	1	-	62	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	9	35	51	28	25	85	24	30	77	16	36	102
	Larvae	2	25	30	-	-	-	-	-	-	-	-	-
Microgobius gulosus	Adult	-	-	-	-	-	-	1	-	56	-	-	-
Clown goby	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Trinectes maculatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Hogchoker	Juvenile	-	-	-	-	-	-	1	-	56	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-

TABLE A-7 (Continued)

ADULT FISH COLLECTION
SEMINOLE ELECTRIC COOPERATIVE
ST. JOHNS RIVER, FLORIDA
CORRIDOR A
OTTER TRAWL, 900 FEET (274.3 M) FROM SHORE
APRIL 4, 1979

		DAY (0630)						NIGHT (1920)					
		TOW A			TOW B			TOW A			TOW B		
Taxon	Life Stage	# Collected	Size Range (mm)		# Collected	Size Range (mm)		# Collected	Size Range (mm)		# Collected	Size Range (mm)	
			Min	Max		Min	Max		Min	Max		Min	Max
Anguilla rostrata	Adult	-	-	-	-	-	-	1	-	410	-	-	-
American eel	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Anchoa mitchilli	Adult	9	51	73	1	-	59	2	52	56	-	-	-
Bay anchovy	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus catus	Adult	1	-	344	2	361	390	3	175	320	-	-	-
White catfish	Juvenile	-	-	-	32	80	155	3	94	150	38	72	173
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus nebulosus	Adult	-	-	-	1	-	175	-	-	-	2	188	272
Brown bullhead	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Ictalurus punctatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	Juvenile	-	-	-	8	70	117	1	-	160	4	119	159
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Lepomis macrochirus	Adult	3	169	188	1	-	218	-	-	-	-	-	-
Bluegill	Juvenile	2	87	93	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Lepomis microlophus	Adult	-	-	-	1	-	216	1	-	200	-	-	-
Redear sunfish	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Micropogon undulatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic croaker	Juvenile	40	38	123	162	49	133	10	56	131	20	34	124
	Larvae	3	25	35	-	-	-	-	-	-	-	-	-
Paralichthys lethostigma	Adult	-	-	-	1	-	203	-	-	-	-	-	-
Southern flounder	Juvenile	-	-	-	-	-	-	-	-	-	-	-	-
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-
Trinectes maculatus	Adult	-	-	-	-	-	-	-	-	-	-	-	-
Hogchoker	Juvenile	-	-	-	-	-	-	3	45	50	1	-	43
	Larvae	-	-	-	-	-	-	-	-	-	-	-	-

TABLE A-8

DENSITIES OF BENTHIC MACROINVERTEBRATES (average #/m^2)
EKMAN DREDGE SAMPLES
AT DISTANCES FROM SHORE
SEMINOLE ELECTRIC COOPERATIVE, INC.
SPRING, 1979

TAXA	50'	150'	250'	350'	700'	900'	Total
Insecta							
Ephemeroptera							0
Baetidae							0
Caenis sp.		14.35					14.35
Diptera							
Chironomidae	14.35		28.71	57.41			100.47
Unid. pupae	14.35						14.35
Ablabesmyia sp.	87.12			14.35			100.47
Coelotanypus sp.			57.41	401.89	344.48	272.71	1,076.49
Cladotanytarsus sp.	43.06		272.71	301.42			617.19
Glyptotendipes sp.				14.35			14.35
Micropsectra sp.				14.35			14.35
Polypedilum sp.	57.41		143.53	803.79			1,004.73
Procladius sp.	43.06	14.35	87.12	401.89	100.47	129.18	775.47
Rheotanytarsus sp.	229.65	114.83	14.35				358.83
Tanytarsus sp.				28.71	272.71	114.83	416.25
Odonata							0
Zygoptera							0
Coenagrionidae							0
Enallagma sp.		57.41					
Crustacea							0
Amphipoda							0
Gammaridae							0
Gammarus spp.		14.35	71.77	28.71			114.83
Talitridae							0
Hyalella sp.			87.12	57.41			143.53
Corophiidae							0
Corophium sp.	14.35					14.35	28.70

TABLE A-8 (Continued)

TAXA	50'	150'	250'	350'	700'	900'	Total
Cladocera	14.35						14.35
Copepoda				28.71	14.35		43.06
Ostracoda				14.35	200.96	86.12	301.42
Isopoda							0
Anthuridae							0
Cyathurapolita sp.	28.71		71.77	330.13			430.61
Sphaeromatidae							0
Cassidinidea lunifrons	14.35	14.35					28.70
Decapoda							
Callinectes sapidus		14.35					14.35
Annelida							
Oligochaeta							0
Naididae sp.							14.35
Nais sp.	71.77			200.95			272.72
Naidium sp.				14.35			14.35
Pristina sp.				14.35			14.35
Tubificidae sp.					28.71	14.35	43.06
Aulodrius pigueti				287.07	588.49	4,262.94	5,138.50
Aulodrilus sp.					1,205.68		1,205.68
Limnodrilus hoffmeisteri			43.06	416.25	86.12	258.36	803.79
Limnodrilus sp.	71.77	14.35	1,492.75	961.67	172.24	459.31	3,172.09
Unid. Setate sp.	14.35			186.59			200.94
							0
Mollusca							0
Gastropoda							0
Ferrissia sp.	43.06						43.06
Pelecypoda							0
Sphaeriidae							0
Pisidium sp.					43.06		43.06
Nematomorphia				200.95	14.35	28.71	244.01
TOTAL	760.71	258.34	2,368.30	4,794.00	3,071.61	5,655.21	16,908.17

TABLE A-9

DENSITIES OF MACROINVERTEBRATES (as determined by tows)
(#/100 m^3) AT DISTANCES FROM SHORE
SEMINOLE ELECTRIC COOPERATIVE, INC.
SPRING, 1979
DAY

TAXA	1*		2*		3		4		5		6		7		8		TOTAL
	50'		150'		250'		350'		500'		700'		900'		mid 900'depth		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Insecta																	0
Diptera																	0
Chironomidae														1.71			1.71
Cladotanytarsus sp.						5.79											5.79
Procladius sp.						1.93											1.93
Rheotanytarsus sp.							2.32										2.32
Tanypodinae sp.													1.14	3.43			4.57
Tanytarsini sp.						13.51	257.90	8.76	2.03			2.00					284.20
Culicidae																	0
Chaoborus sp.							2.32								4.36		6.68
Hydracarina														1.71			1.71
Crustacea																	0
Cladocera									2.03		2.07			1.71	2.91		8.72
Copepoda																	0
Argulus sp.												2.00					2.00
Oligochaeta																	0
Naididae																	0
Stylaria sp.								4.38			4.15		1.14			6.67	16.34
Nais sp.												2.00					2.00
Tubificidae																	0
Limnodrilus sp.						3.80											3.80
Aulodrilus sp.						5.70										2.22	7.92
Total						30.73	262.54	13.14	4.06	0	6.22	6.00	2.28	8.56	7.27	8.89	349.69

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* Too shallow for tows

TABLE A-9 (Continued)

TAXA	1* 50' A	1* 50' B	2* 150' A	2* 150' B	3 250' A	3 250' B	4 350' A	4 350' B	5 500' A	5 500' B	6 700' A	6 700' B	7 900' A	7 900' B	8 900' mid depth A	8 900' mid depth B	TOTAL
Insecta																	0
Ephemeroptera																	0
Baetidae																	0
Caenis sp.					5.76	13.38	7.10	6.06	6.00	1.43	4.69	4.73	2.85	1.48	1.48	1.61	56.57
Diptera																	0
Chironomidae					2.88							1.58					4.46
Ablabesmyia sp.						1.34		3.03	1.50					1.48			7.35
Chironomus sp.																	0
Cladotanytarsus sp.																	0
Einfeldia sp.						1.34											1.34
Parachironomus sp.												1.58					1.58
Procladius sp.											1.56						1.56
Rheotanytarsus sp.						1.34											1.34
Tanytarsus sp.							1.42	1.51	1.50								4.43
Tanytarsini sp.					2.88	20.07	34.06		7.50				1.42				65.93
Tanypodinae							8.52	6.06	1.50			1.58					17.66
Culicidae																	0
Chaoborus spp.					63.35	139.16	85.16	19.69	30.00	32.79	12.51	9.46	5.69	1.48	20.74	8.04	428.07
Hydracarina					2.88		7.10		4.50		1.56	3.15	4.27				23.46
Crustacea																	0
Amphipoda																	0
Gammaridae																	0
Gammarus sp.					103.66	240.85	173.16	137.85	85.49	72.71	34.42	82.03	32.72	50.32	108.16	125.36	1246.73
Crangonyx sp.												1.58					1.58
Talitridae																	0
Hyalella sp.					8.64	2.68	4.26	12.12	1.50	8.55	1.56				2.96		42.27
Unidentified					155.50	57.54	45.42	30.30	21.00	48.47	6.26	11.04	2.85		41.49	33.75	453.62
Corophiidae																	0
Corophium sp.						6.69	24.13	18.18	6.00	7.13					1.48		63.61
Cladocera					34.55	42.82	35.48	146.94	21.00	11.40	4.69	18.93	8.54	32.56	80.01	46.61	483.53
Copepoda					118.06	487.05	225.68	260.55	152.98	79.83	14.08	88.34	17.07	48.84	168.91	117.33	1778.72
Argulus sp.																	0
Decapoda																	0
Callinectes sapidus											1.56			1.48			3.04

TABLE A-9 (Continued)

	1*		2*		3		4		5		6		7		8		
TAXA	50'		150'		250'		350'		500'		700'		900'		mid 900' depth		TOTAL
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Hemiptera																	0
Corixidae																	0
Corixid					2.88												2.88
Odonata																	
Zygoptera																	0
Coenagrionidae																	0
											3.13						3.13
Enallagma sp.								1.51	3.00	1.43		1.58					7.52
Coleoptera																	0
Haliplidae																	0
Peltodytes									1.50								1.50
Isopoda																	0
Anthuridae																	0
Cyathura					5.76	12.04	8.52	4.54	9.00	5.70		3.15	1.42		4.45		54.58
polita																	
Sphaeromatidae																	0
Cassidinidea					2.88												2.88
lunifrons																	
Sphaeroma sp.							1.42										1.42
Mysidacea																	0
Mysidae																	0
Mysidopsis																	0
bigelowi					2.88	2.68	5.68								5.93		17.17
Oligochaeta																	0
Naididae								10.60									10.60
Stylaria sp.					8.64	1.34	11.35		21.00	1.43	10.95	3.15	2.85		4.45	1.61	66.77
Nais sp.						1.34			3.00								4.34
Tubificidae																	0
Limnodrilus sp.															1.48		1.48
Gastropoda																	0
Ferrissia sp.								1.51									1.51
TOTAL				0	521.20	1031.66	678.46	660.45	377.97	270.87	96.97	231.88	79.68	137.64	441.54	334.31	4862.63

APPENDIX B

RESULTS OF PHASE II STUDIES

CONTINGENCY TABLE

TOTAL NUMBER OF STRONGYLURA MARINA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY, BLOCK, POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	2	.00	.00	.00	.00	.00	.00	.00	.00	
2	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	2	.00	.00	.00	.00	.00	.00	.00	.00	
3	1	.00	.00	.00	.00	.00	.00	.00	.00	2.59
3	2	.00	.00	.00	2.59	.00	.00	.00	.00	
4	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	2	.00	.00	.00	.00	.00	.00	.00	.00	
TOTALS		.0	.0	.0	2.6	.0	.0	.0	.0	2.59

OTHER TOTALS

TOTAL FOR 1MM SCREEN = .00

MEAN FOR 1MM SCREEN = .00

TOTAL FOR 2MM SCREEN = 2.59

MEAN FOR 2MM SCREEN = .08

CONTINGENCY TABLE

TOTAL NUMBER OF STRONGYLURA MARINA   ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	2	.00	.00	.00	.00	.00	.00	.00	.00	
2	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	2	.00	.00	.00	.00	.00	.00	.00	.00	
3	1	.00	.00	.00	.00	.00	.00	.00	.00	2.59
3	2	.00	.00	.00	2.59	.00	.00	.00	.00	
4	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	2	.00	.00	.00	.00	.00	.00	.00	.00	
TOTALS		.0	.0	.0	2.6	.0	.0	.0	.0	2.59

OTHER TOTALS

TOTAL FOR 1MM SCREEN = .00   TOTAL FOR 2MM SCREEN = 2.59

MEAN FOR 1MM SCREEN = .00   MEAN FOR 2MM SCREEN = .08

CONTINGENCY TABLE

TOTAL NUMBER OF LUCANIA PARVA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	2	.00	.00	.00	.00	.00	.00	.00	.00	
2	1	.00	.00	.00	.00	.00	.00	.00	.00	5.20
2	2	.00	.00	.00	.00	2.60	.00	2.60	.00	
3	1	.00	.00	.00	.00	2.59	2.60	7.81	.00	15.61
3	2	.00	.00	.00	.00	.00	.00	2.60	.00	
4	1	.00	.00	.00	.00	.00	.00	12.99	.00	20.78
4	2	.00	.00	.00	.00	.00	.00	7.79	.00	
TOTALS		.0	.0	.0	.0	5.2	2.6	33.8	.0	41.58

OTHER TOTALS

TOTAL FOR 1MM SCREEN =	25.99	TOTAL FOR 2MM SCREEN =	15.59
MEAN FOR 1MM SCREEN =	.81	MEAN FOR 2MM SCREEN =	.49

CONTINGENCY TABLE

TOTAL NUMBER OF LUCANIA PARVA ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	2	.00	.00	.00	.00	.00	.00	.00	.00	
2	1	.00	.00	.00	.00	.00	.00	.00	.00	5.20
2	2	.00	.00	.00	.00	2.60	.00	2.60	.00	
3	1	.00	.00	.00	.00	5.18	2.60	10.41	.00	20.80
3	2	.00	.00	.00	.00	.00	.00	2.60	.00	
4	1	.00	.00	.00	.00	.00	.00	12.99	.00	20.78
4	2	.00	.00	.00	.00	.00	.00	7.79	.00	
TOTALS		.0	.0	.0	.0	7.8	2.6	36.4	.0	46.78

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 31.18

MEAN FOR 1MM SCREEN = .97

TOTAL FOR 2MM SCREEN = 15.59

MEAN FOR 2MM SCREEN = .49

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                              CONTINGENCY TABLE
                         TOTAL NUMBER OF   MENIDIA BERYLLINA          PROLARVAE  PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY,BLOCK,POSITION AND SCREEN
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                   INTAKE STUDIES
                                         DAY OF STUDY

BLOCK     SCREEN                                                                                 TOTALS

                    1       2       3       4       5       6       7       8
  1         1      .00     .00     .00     .00     .00     .00     .00     .00                    .00
  1         2      .00     .00     .00     .00     .00     .00     .00     .00
  2         1      .00     .00     .00     .00     .00     .00     .00     .00                    .00
  2         2      .00     .00     .00     .00     .00     .00     .00     .00
  3         1      .00     .00     .00     .00     .00     .00     .00     .00                    .00
  3         2      .00     .00     .00     .00     .00     .00     .00     .00
  4         1      .00     .00     .00     .00     .00     .00     .00     .00                   5.19
  4         2     2.58     .00     .00     .00     .00     .00     .00    2.60

------------------------------------------------------------------------------------------------------

    TOTALS            2.6      .0      .0      .0      .0      .0      .0     2.6
                                                                                                 5.19

                                     OTHER TOTALS
                 TOTAL FOR 1MM SCREEN =           .00         TOTAL FOR 2MM SCREEN =         5.19
                 MEAN FOR 1MM SCREEN =            .00         MEAN FOR 2MM SCREEN =           .16
```

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY, BLOCK, POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	2.60	2.58	.00	2.59	18.15	7.82	2.60	.00	64.92
1	2	7.79	.00	.00	5.17	.00	10.42	2.60	2.59	
2	1	2.58	.00	2.59	44.12	153.29	.00	169.18	.00	668.16
2	2	.00	.00	.00	15.57	171.48	23.45	85.89	.00	
3	1	.00	.00	.00	.00	5.18	130.15	218.63	.00	694.92
3	2	.00	.00	.00	.00	7.78	124.95	208.22	.00	
4	1	.00	.00	.00	.00	7.79	.00	57.13	.00	171.45
4	2	.00	.00	.00	.00	2.60	10.41	77.91	15.62	
TOTALS		13.0	2.6	2.6	67.5	366.3	307.2	822.2	18.2	1599.46

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 827.00

MEAN FOR 1MM SCREEN = 25.84

TOTAL FOR 2MM SCREEN = 772.46

MEAN FOR 2MM SCREEN = 24.14

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	20.77	5.17	5.19	2.59	59.63	65.15	46.85	.00	319.69
1	2	10.39	.00	28.55	15.52	.00	31.27	23.43	5.19	
2	1	10.32	.00	28.52	93.44	303.98	44.30	372.20	.00	1697.84
2	2	2.58	.00	.00	33.74	465.07	99.03	239.46	5.21	
3	1	.00	.00	.00	.00	49.26	351.41	515.35	.00	1868.35
3	2	.00	.00	.00	10.35	64.81	377.44	499.74	.00	
4	1	.00	.00	.00	.00	7.79	23.43	309.05	18.22	742.96
4	2	2.58	.00	5.20	.00	7.79	28.63	306.45	33.83	
TOTALS		46.6	5.2	67.5	155.6	958.3	1020.7	2312.5	62.4	4628.84

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 2332.60

MEAN FOR 1MM SCREEN = 72.89

TOTAL FOR 2MM SCREEN = 2296.24

MEAN FOR 2MM SCREEN = 71.76

CONTINGENCY TABLE

TOTAL NUMBER OF GOBIOSOMA BOSCI POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	2.60
1	2	.00	.00	.00	.00	.00	.00	2.60	.00	
2	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	2	.00	.00	.00	.00	.00	.00	.00	.00	
3	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	2	.00	.00	.00	.00	.00	.00	.00	.00	
4	1	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	2	.00	.00	.00	.00	.00	.00	.00	.00	
TOTALS		.0	.0	.0	.0	.0	.0	2.6	.0	2.60

OTHER TOTALS

TOTAL FOR 1MM SCREEN = .00

MEAN FOR 1MM SCREEN = .00

TOTAL FOR 2MM SCREEN = 2.60

MEAN FOR 2MM SCREEN = .08

```
                                   CONTINGENCY TABLE
                          TOTAL NUMBER OF   GOBIOSOMA BOSCI              ALL LARVAE PER 100 CUBIC METERS
                          ACTUAL DENSITIES
                          BY DAY,BLOCK,POSITION AND SCREEN
                          SEMINOLE ELECTRIC COOPERATIVE, INC
                                      INTAKE STUDIES
                                            DAY OF STUDY

BLOCK      SCREEN                                                                                     TOTALS

                    1        2        3        4        5        6        7        8

  1          1     .00      .00      .00      .00      .00      .00      .00      .00                2.60
  1          2     .00      .00      .00      .00      .00      .00     2.60      .00
  2          1     .00      .00      .00      .00      .00      .00      .00      .00                 .00
  2          2     .00      .00      .00      .00      .00      .00      .00      .00
  3          1     .00      .00      .00      .00      .00      .00      .00      .00                 .00
  3          2     .00      .00      .00      .00      .00      .00      .00      .00
  4          1     .00      .00      .00      .00      .00      .00      .00      .00                 .00
  4          2     .00      .00      .00      .00      .00      .00      .00      .00

-------------------------------------------------------------------------------------------------------------

     TOTALS                .0       .0       .0       .0       .0       .0      2.6       .0
                                                                                                       2.60

                                       OTHER TOTALS
                TOTAL FOR 1MM SCREEN =           .00             TOTAL FOR 2MM SCREEN =           2.60
                MEAN FOR 1MM SCREEN =            .00             MEAN FOR 2MM SCREEN =             .08
```

CONTINGENCY TABLE

TOTAL NUMBER OF UNIDENTIFIABLE
ACTUAL DENSITIES
BY DAY,BLOCK,POSITION AND SCREEN
SEMINOLE ELECTRIC COOPERATIVE, INC
INTAKE STUDIES

ALL LARVAE PER 100 CUBIC METERS

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	5.19	2.58	31.15	.00	25.92	20.85	20.82	2.59	241.68
1	2	18.17	2.58	20.77	10.35	10.37	36.48	33.84	.00	
2	1	2.58	2.59	12.96	5.19	77.94	7.82	54.66	13.01	361.44
2	2	.00	.00	15.56	5.19	54.56	49.51	52.06	7.81	
3	1	2.59	.00	.00	.00	41.48	122.34	109.32	2.60	411.02
3	2	.00	.00	2.60	.00	5.18	62.47	52.06	10.39	
4	1	.00	2.60	.00	.00	.00	20.82	161.02	7.81	288.35
4	2	.00	.00	.00	2.59	10.38	.00	72.72	10.41	
TOTALS		28.5	10.4	83.0	23.3	225.8	320.3	556.5	54.6	
										1302.49

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 756.45
MEAN FOR 1MM SCREEN = 23.64

TOTAL FOR 2MM SCREEN = 546.04
MEAN FOR 2MM SCREEN = 17.06

```
                              CONTINGENCY TABLE
                    TOTAL NUMBER OF   ALL TAXA                  PROLARVAE  PER 100 CUBIC METERS
                    ACTUAL DENSITIES
                    BY DAY,BLOCK,POSITION AND SCREEN
                    SEMINOLE ELECTRIC COOPERATIVE, INC
                                 INTAKE STUDIES
                                          DAY OF STUDY

BLOCK     SCREEN                                                                          TOTALS

                   1        2        3        4        5        6        7        8
  1         1     .00      .00      .00      .00      .00      .00      .00      .00         .00
  1         2     .00      .00      .00      .00      .00      .00      .00      .00
  2         1     .00      .00      .00      .00      .00      .00      .00      .00        5.21
  2         2     .00      .00      .00      .00      .00      .00     5.21      .00
  3         1     .00      .00      .00      .00      .00      .00      .00      .00         .00
  3         2     .00      .00      .00      .00      .00      .00      .00      .00
  4         1     .00      .00      .00      .00      .00      .00      .00      .00        5.19
  4         2    2.58      .00      .00      .00      .00      .00      .00     2.60

------------------------------------------------------------------------------------------------

     TOTALS          2.6       .0       .0       .0       .0       .0      5.2      2.6
                                                                                          10.39

                                 OTHER TOTALS
          TOTAL FOR 1MM SCREEN =           .00        TOTAL FOR 2MM SCREEN =        10.39
          MEAN FOR 1MM SCREEN =            .00        MEAN FOR 2MM SCREEN =           .32
```

CONTINGENCY TABLE

TOTAL NUMBER OF ALL TAXA

POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	2.60	2.58	.00	2.59	18.15	10.42	2.60	.00	70.13
1	2	7.79	.00	.00	5.17	.00	10.42	5.21	2.59	
2	1	2.58	.00	2.59	44.12	153.29	.00	169.18	.00	678.56
2	2	.00	.00	.00	18.17	176.67	23.45	88.49	.00	
3	1	.00	.00	.00	.00	7.78	132.76	226.44	.00	713.11
3	2	.00	.00	.00	2.59	7.78	124.95	210.83	.00	
4	1	.00	.00	.00	.00	7.79	.00	70.12	.00	192.23
4	2	.00	.00	.00	.00	2.60	10.41	85.70	15.62	
TOTALS		13.0	2.6	2.6	72.6	374.0	312.4	858.6	18.2	
										1654.03

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 855.59

MEAN FOR 1MM SCREEN = 26.74

TOTAL FOR 2MM SCREEN = 798.44

MEAN FOR 2MM SCREEN = 24.95

CONTINGENCY TABLE

TOTAL NUMBER OF ALL TAXA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

		DAY OF STUDY								
BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	25.96	7.75	36.34	2.59	85.55	88.60	67.67	2.59	566.57
1	2	28.56	2.58	49.32	25.87	10.37	67.75	59.86	5.19	
2	1	12.90	2.59	41.49	98.63	381.93	52.12	426.86	13.01	2074.88
2	2	2.58	.00	15.56	41.53	524.83	148.54	299.32	13.01	
3	1	2.59	.00	.00	.00	95.92	476.36	635.08	2.60	2302.76
3	2	.00	.00	2.60	12.93	69.99	439.92	554.39	10.39	
4	1	.00	2.60	.00	.00	7.79	44.25	483.05	26.03	1054.69
4	2	2.58	.00	5.20	2.59	18.17	31.24	386.96	44.24	
TOTALS		75.2	15.5	150.5	184.1	1194.5	1348.8	2913.2	117.1	
										5998.91

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 3122.84

MEAN FOR 1MM SCREEN = 97.59

TOTAL FOR 2MM SCREEN = 2876.07

MEAN FOR 2MM SCREEN = 89.88

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA PUPAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	216.34	164.04	311.67	471.76	184.94	458.50	239.31	72.56	3653.23
1	2	124.69	51.26	216.17	225.62	318.50	.00	468.21	129.66	
2	1	.00	585.68	290.57	195.50	782.15	145.94	301.74	260.02	5990.35
2	2	388.88	565.13	352.84	207.77	792.87	372.25	426.60	322.42	
3	1	174.74	.00	72.06	207.08	534.26	416.36	322.55	.00	4861.33
3	2	139.89	64.54	92.64	327.92	544.53	801.49	374.57	788.70	
4	1	61.87	129.73	175.19	863.37	373.95	499.63	591.76	330.52	6988.75
4	2	54.28	166.05	123.66	643.36	534.56	578.42	623.31	1239.08	
TOTALS		1160.7	1726.4	1634.8	3142.4	4065.8	3272.6	3348.1	3142.9	21493.65

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 9433.77

MEAN FOR 1MM SCREEN = 294.81

TOTAL FOR 2MM SCREEN = 12059.88

MEAN FOR 2MM SCREEN = 376.87

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA ADULT PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	10.25	.00	.00	30.82	.00	.00	.00	61.88
1	2	.00	.00	.00	.00	.00	.00	20.81	.00	
2	1	.00	.00	.00	.00	.00	.00	83.24	.00	83.24
2	2	.00	.00	.00	.00	.00	.00	.00	.00	
3	1	.00	.00	30.88	.00	.00	20.82	41.62	.00	114.14
3	2	.00	.00	.00	.00	.00	20.82	.00	.00	
4	1	5.16	.00	30.92	.00	.00	.00	.00	.00	36.07
4	2	.00	.00	.00	.00	.00	.00	.00	.00	
TOTALS		5.2	10.3	61.8	.0	30.8	41.6	145.7	.0	
										295.33

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 253.70

MEAN FOR 1MM SCREEN = 7.93

TOTAL FOR 2MM SCREEN = 41.63

MEAN FOR 2MM SCREEN = 1.30

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY, BLOCK, POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

		DAY OF STUDY								
BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	247.24	174.29	477.90	502.52	236.31	531.44	291.33	103.66	4310.73
1	2	124.69	51.26	267.64	225.62	380.15	.00	551.45	145.21	
2	1	347.95	595.95	311.33	205.79	823.31	208.48	499.43	280.82	6918.53
2	2	388.88	626.78	352.84	228.54	885.54	372.25	447.41	343.22	
3	1	185.02	139.41	113.23	207.08	606.18	541.26	364.17	767.94	6304.17
3	2	139.89	72.29	92.64	368.91	606.18	863.94	416.19	819.83	
4	1	67.03	129.73	206.10	863.37	373.95	520.45	622.90	330.52	7366.12
4	2	54.28	176.43	133.97	664.12	575.68	619.74	664.87	1362.99	
TOTALS		1555.0	1966.1	1955.7	3266.0	4487.3	3657.6	3857.7	4154.2	
										24899.54

OTHER TOTALS

TOTAL FOR 1MM SCREEN =	11876,11	TOTAL FOR 2MM SCREEN =	13023.43
MEAN FOR 1MM SCREEN =	371.13	MEAN FOR 2MM SCREEN =	406.98

CONTINGENCY TABLE

TOTAL NUMBER OF HYDRACARINA LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY, BLOCK, POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	10.27	83.36	.00	.00	129.63
1	2	.00	10.25	.00	.00	20.55	.00	.00	5.19	
2	1	.00	.00	.00	.00	.00	.00	10.40	.00	72.52
2	2	.00	20.55	20.76	.00	.00	.00	20.81	.00	
3	1	.00	7.75	20.59	20.71	.00	.00	.00	.00	116.42
3	2	5.18	.00	10.29	.00	10.27	20.82	20.81	.00	
4	1	.00	.00	.00	.00	.00	.00	20.76	2.60	147.12
4	2	.00	.00	.00	.00	41.12	82.63	.00	.00	
TOTALS		5.2	38.5	51.6	20.7	82.2	186.8	72.8	7.8	
										465.68

OTHER TOTALS

TOTAL FOR 1MM SCREEN =	176.45	TOTAL FOR 2MM SCREEN =	289.23
MEAN FOR 1MM SCREEN =	5.51	MEAN FOR 2MM SCREEN =	9.04

CONTINGENCY TABLE

TOTAL NUMBER OF HYDRACARINA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	.00	.00	.00	.00	10.27	83.36	.00	.00	129.63
1	2	.00	10.25	.00	.00	20.55	.00	.00	5.19	
2	1	.00	.00	.00	.00	.00	.00	10.40	.00	72.52
2	2	.00	20.55	20.76	.00	.00	.00	20.81	.00	
3	1	.00	7.75	20.59	20.71	.00	.00	.00	.00	116.42
3	2	5.18	.00	10.29	.00	10.27	20.82	20.81	.00	
4	1	.00	.00	.00	.00	.00	.00	20.76	2.60	147.12
4	2	.00	.00	.00	.00	41.12	82.63	.00	.00	
TOTALS		5.2	38.5	51.6	20.7	82.2	186.8	72.8	7.8	465.68

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 176.45

MEAN FOR 1MM SCREEN = 5.51

TOTAL FOR 2MM SCREEN = 289.23

MEAN FOR 2MM SCREEN = 9.04

CONTINGENCY TABLE

TOTAL NUMBER OF AMPHIPODA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	515.09	1230.28	727.24	851.21	2815.13	2615.54	1196.55	995.15	20806.59
1	2	727.36	666.40	854.38	502.52	2517.18	.00	4224.34	368.22	
2	1	419.59	462.38	1743.45	895.20	740.98	354.42	1383.83	270.42	15165.70
2	2	603.79	452.10	975.50	415.53	2265.34	1571.74	2216.22	395.22	
3	1	205.58	338.21	339.69	1056.10	883.58	3122.68	1675.17	311.33	14376.45
3	2	310.87	327.88	195.58	1352.68	616.45	1884.02	1082.10	674.54	
4	1	113.43	103.78	175.19	349.46	747.90	1249.07	1370.39	400.79	12002.91
4	2	108.56	176.43	247.32	228.29	1644.80	2313.68	1080.41	1693.41	
TOTALS		3004.3	3757.5	5258.4	5651.0	12231.4	13111.1	14229.0	5109.1	
										62351.65

OTHER TOTALS

TOTAL FOR 1MM SCREEN = 29658.79

MEAN FOR 1MM SCREEN = 926.84

TOTAL FOR 2MM SCREEN = 32692.86

MEAN FOR 2MM SCREEN = 1021.65

CONTINGENCY TABLE
TOTAL NUMBER OF ISOPODA LARVAE PER 100 CUBIC METERS
ACTUAL DENSITIES
BY DAY,BLOCK,POSITION AND SCREEN
SEMINOLE ELECTRIC COOPERATIVE, INC
INTAKE STUDIES
DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	30.91	123.03	394.79	61.53	10.27	197.99	83.24	.00	1717.00
1	2	.00	61.51	82.35	164.09	195.21	.00	291.33	20.74	
2	1	71.64	30.83	.00	30.87	205.83	.00	41.62	93.61	1094.74
2	2	51.17	61.65	166.04	20.78	123.56	82.72	72.83	41.60	
3	1	51.40	25.82	20.59	20.71	61.65	20.82	166.48	31.13	782.61
3	2	36.27	49.05	51.47	122.97	41.10	41.64	10.40	31.13	
4	1	36.09	10.38	92.75	123.34	62.32	10.41	321.83	127.52	1818.86
4	2	20.68	51.89	51.53	124.52	41.12	82.63	166.22	495.63	
TOTALS		298.1	414.2	859.5	668.8	741.1	436.2	1154.0	841.4	5413.22

OTHER TOTALS

TOTAL FOR 1MM SCREEN =	2559.37	TOTAL FOR 2MM SCREEN =	2853.85
MEAN FOR 1MM SCREEN =	79.98	MEAN FOR 2MM SCREEN =	89.18

CONTINGENCY TABLE

TOTAL NUMBER OF ISOPODA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8	TOTALS
1	1	30.91	123.03	394.79	61.53	10.27	197.99	83.24	.00	1717.00
1	2	.00	61.51	82.35	164.09	195.21	.00	291.33	20.74	
2	1	71.64	30.83	.00	30.87	205.83	.00	41.62	93.61	1094.74
2	2	51.17	61.65	166.04	20.78	123.56	82.72	72.83	41.60	
3	1	51.40	25.82	20.59	20.71	61.65	20.82	166.48	31.13	782.61
3	2	36.27	49.05	51.47	122.97	41.10	41.64	10.40	31.13	
4	1	36.09	10.38	92.75	123.34	62.32	10.41	321.83	127.52	1818.86
4	2	20.68	51.89	51.53	124.52	41.12	82.63	166.22	495.63	
TOTALS		298.1	414.2	859.5	668.8	741.1	436.2	1154.0	841.4	5413.22

OTHER TOTALS

TOTAL FOR 1MM SCREEN =	2559.37	TOTAL FOR 2MM SCREEN =	2853.85
MEAN FOR 1MM SCREEN =	79.98	MEAN FOR 2MM SCREEN =	89.18

CONTINGENCY TABLE

TOTAL NUMBER OF DECOPODA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY,BLOCK,POSITION AND SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	SCREEN	1	2	3	4	5	6	7	8		TOTALS
1	1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1	2	.00	.00	.00	.00	.00	.00	.00	.00		
2	1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	2	.00	.00	.00	.00	.00	.00	.00	.00		
3	1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	2	.00	.00	.00	.00	.00	.00	.00	.00		
4	1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	2	.00	.00	.00	.00	.00	.00	.00	.00		
TOTALS		.0	.0	.0	.0	.0	.0	.0	.0		.00

OTHER TOTALS

TOTAL FOR 1MM SCREEN = .00

MEAN FOR 1MM SCREEN = .00

TOTAL FOR 2MM SCREEN = .00

MEAN FOR 2MM SCREEN = .00

CONTINGENCY TABLE

TOTAL NUMBER OF STRONGYLURA MARINA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	7.80	.00	.00	.00	.00	7.80
4	.00	.00	.00	.00	.00	.00	6.75	.00	6.75
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	7.8	.0	.0	6.7	.0	14.55

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 14.55

MEAN FOR 9.5MM SCREEN = .36

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                                    CONTINGENCY TABLE
                              TOTAL NUMBER OF   STRONGYLURA MARINA          ALL LARVAE PER 100 CUBIC METERS
                              ACTUAL DENSITIES
                              BY DAY AND BLOCK FOR 9.5MM SCREEN
                              SEMINOLE ELECTRIC COOPERATIVE, INC
                                        INTAKE STUDIES
                                              DAY OF STUDY

BLOCK
                                                                          TOTALS
                    1       2       3       4       5       6       7       8
  1               .00     .00     .00     .00     .00     .00     .00     .00          .00
  2               .00     .00     .00     .00     .00     .00     .00     .00          .00
  3               .00     .00     .00    7.80     .00     .00     .00     .00         7.80
  4               .00     .00     .00     .00     .00     .00    6.75     .00         6.75
  5               .00     .00     .00     .00     .00     .00     .00     .00          .00

------------------------------------------------------------------------------------------------
    TOTALS            .0      .0      .0     7.8      .0      .0     6.7      .0
                                                                                     14.55

                                         OTHER TOTALS
                  TOTAL FOR 9.5MM SCREEN =      14.55             MEAN FOR 9.5MM SCREEN =        .36
```

```
                          CONTINGENCY TABLE
                 TOTAL NUMBER OF   LUCANIA PARVA            PROLARVAE  PER 100 CUBIC METERS
                 ACTUAL DENSITIES
                 BY DAY AND BLOCK FOR 9.5MM SCREEN
                 SEMINOLE ELECTRIC COOPERATIVE, INC
                              INTAKE STUDIES
                                        DAY OF STUDY

BLOCK
                                                                         TOTALS
               1       2       3       4       5       6       7       8

  1          .00     .00     .00     .00     .00     .00     .00     .00           .00
  2          .00     .00     .00     .00     .00     .00     .00     .00           .00
  3          .00     .00     .00     .00     .00    7.80     .00     .00          7.80
  4          .00     .00     .00     .00     .00     .00   13.49     .00         13.49
  5          .00     .00     .00     .00     .00     .00     .00     .00           .00

------------------------------------------------------------------------------------------

    TOTALS         .0      .0      .0      .0      .0     7.8    13.5      .0
                                                                                  21.29

                              OTHER TOTALS
           TOTAL FOR 9.5MM SCREEN =      21.29          MEAN FOR 9.5MM SCREEN =      .53
```

```
                         CONTINGENCY TABLE
                 TOTAL NUMBER OF   LUCANIA PARVA           ALL LARVAE PER 100 CUBIC METERS
                 ACTUAL DENSITIES
                 BY DAY AND BLOCK FOR 9.5MM SCREEN
                 SEMINOLE ELECTRIC COOPERATIVE, INC
                          INTAKE STUDIES
                                  DAY OF STUDY

BLOCK
                                                                             TOTALS
              1       2       3       4       5       6       7       8

  1          .00     .00     .00     .00     .00     .00    7.75     .00          7.75
  2          .00     .00     .00     .00     .00     .00     .00     .00           .00
w  3(`      .00     .00     .00     .00     .00    7.80   15.60     .00         23.40
  4          .00  $  .00@    .00     .00     .00     .00   13.49     .00         13.49
  5          .00     .00     .00     .00     .00     .00     .00     .00           .00

--------------------------------------------------------------------------------------------

    TOTALS       .0      .0      .0      .0      .0     7.8    36.8      .0
                                                                                  44.64

                           OTHER TOTALS
          TOTAL FOR 9.5MM SCREEN =      44.64          MEAN FOR 9.5MM SCREEN =       1.12
```

CONTINGENCY TABLE

TOTAL NUMBER OF GAMBUSIA AFFINIS ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	6.75	.00	6.75
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	.0	.0	6.7	.0	6.75

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 6.75

MEAN FOR 9.5MM SCREEN = .17

```
                         CONTINGENCY TABLE
                    TOTAL NUMBER OF   MENIDIA BERYLLINA          PROLARVAE  PER 100 CUBIC METERS
                    ACTUAL DENSITIES
                    BY DAY AND BLOCK FOR 9.5MM SCREEN
                    SEMINOLE ELECTRIC COOPERATIVE, INC
                              INTAKE STUDIES
                                   DAY OF STUDY

BLOCK
                                                                                  TOTALS
                 1        2        3        4        5        6        7        8

  1            .00      .00      .00     7.63      .00      .00      .00      .00           7.63
  2            .00      .00      .00      .00      .00      .00      .00      .00            .00
  3            .00      .00      .00      .00      .00      .00      .00      .00            .00
  4            .00      .00     7.73      .00      .00      .00      .00      .00           7.73
  5            .00      .00      .00      .00      .00      .00      .00      .00            .00

------------------------------------------------------------------------------------------------

    TOTALS         .0       .0      7.7      7.6       .0       .0       .0       .0
                                                                                             15.35

                                 OTHER TOTALS
           TOTAL FOR 9.5MM SCREEN =        15.35             MEAN FOR 9.5MM SCREEN =         .38
```

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

BLOCK	DAY OF STUDY 1	2	3	4	5	6	7	8	TOTALS
1	6.83	4.95	.00	7.63	23.25	53.98	46.49	7.80	150.92
2	.00	.00	15.06	.00	46.66	74.43	39.00	.00	175.15
3	.00	.00	.00	171.67	101.10	54.60	163.79	7.77	498.94
4	.00	.00	.00	.00	15.55	61.99	236.12	.00	313.67
5	.00	.00	.00	.00	.00	7.77	62.19	15.60	85.56
TOTALS	6.8	5.0	15.1	179.3	186.6	252.8	547.6	31.2	1224.25

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 1224.25

MEAN FOR 9.5MM SCREEN = 30.61

CONTINGENCY TABLE
TOTAL NUMBER OF MENIDIA BERYLLINA — ALL LARVAE PER 100 CUBIC METERS
ACTUAL DENSITIES
BY DAY AND BLOCK FOR 9.5MM SCREEN
SEMINOLE ELECTRIC COOPERATIVE, INC
INTAKE STUDIES

	DAY OF STUDY								
BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	34.14	9.90	15.40	30.50	100.77	134.94	193.71	15.60	534.96
2	.00	.00	52.70	.00	171.10	311.26	101.40	7.75	644.20
3	.00	.00	.00	234.09	139.99	195.01	397.79	7.77	974.65
4	.00	.00	7.73	.00	62.22	131.73	566.69	.00	768.37
5	.00	6.16	.00	.00	.00	7.77	186.57	15.60	216.11
TOTALS	34.1	16.1	75.8	264.6	474.1	780.7	1446.2	46.7	3138.29

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 3138.29

MEAN FOR 9.5MM SCREEN = 78.46

```
                               CONTINGENCY TABLE
                         TOTAL NUMBER OF   GOBIOSOMA BOSCI              ALL LARVAE PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR 9.5MM SCREEN
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                 INTAKE STUDIES
                                      DAY OF STUDY

BLOCK
                                                                             TOTALS
                 1        2        3        4        5        6        7        8
   1            .00      .00      .00      .00      .00      .00      .00      .00             .00
   2            .00      .00      .00      .00      .00     6.77      .00      .00            6.77
   3            .00      .00      .00      .00      .00      .00      .00      .00             .00
   4            .00      .00      .00      .00      .00      .00      .00      .00             .00
   5            .00      .00      .00      .00      .00      .00      .00      .00             .00

------------------------------------------------------------------------------------------------------
    TOTALS         .0       .0       .0       .0       .0      6.8       .0       .0
                                                                                               6.77

                                OTHER TOTALS
               TOTAL FOR 9.5MM SCREEN =      6.77          MEAN FOR 9.5MM SCREEN =          .17
```

CONTINGENCY TABLE

TOTAL NUMBER OF UNIDENTIFIABLE ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	13.66	.00	7.70	.00	.00	33.73	92.98	15.60	163.67
2	.00	7.73	.00	.00	54.44	74.43	.00	7.75	144.35
3	7.73	.00	6.05	.00	23.33	39.00	155.99	.00	232.11
4	.00	.00	.00	7.78	7.78	.00	175.40	23.40	214.36
5	.00	.00	7.73	7.75	.00	15.55	108.83	38.99	178.86
TOTALS	21.4	7.7	21.5	15.5	85.5	162.7	533.2	85.7	
									933.33

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 933.33

MEAN FOR 9.5MM SCREEN = 23.33

CONTINGENCY TABLE

TOTAL NUMBER OF ALL TAXA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	47.79	9.90	23.11	30.50	100.77	175.42	294.43	31.20	713.12
2	.00	7.73	52.70	.00	225.54	392.45	101.40	15.49	795.31
3	7.73	.00	6.05	241.90	163.32	241.82	569.38	7.77	1237.96
4	.00	.00	7.73	7.78	69.99	131.73	769.08	23.40	1009.71
5	.00	6.16	7.73	7.75	.00	31.10	295.41	54.59	402.74
TOTALS	55.5	23.8	97.3	287.9	559.6	972.5	2029.7	132.5	4158.84

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 4158.84

MEAN FOR 9.5MM SCREEN = 103.97

CONTINGENCY TABLE

TOTAL NUMBER OF EPHEMEROPTERA NYMPH PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	243.82	.00	38.51	15.25	.00	53.96	.00	.00	351.54
2	.00	7.73	29.86	24.82	.00	.00	93.54	7.75	163.69
3	15.46	30.81	18.15	78.04	61.65	62.38	.00	.00	266.49
4	30.51	.00	.00	.00	.00	.00	.00	31.17	61.68
5	.00	.00	.00	.00	7.78	31.09	.00	.00	38.87
TOTALS	289.8	38.5	86.5	118.1	69.4	147.4	93.5	38.9	882.26

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 882.26

MEAN FOR 9.5MM SCREEN = 22.06

CONTINGENCY TABLE

TOTAL NUMBER OF EPHEMEROPTERA ADULT PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

	DAY OF STUDY								
BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	54.18	.00	.00	.00	.00	.00	.00	.00	54.18
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	54.2	.0	.0	.0	.0	.0	.0	.0	54.18

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 54.18

MEAN FOR 9.5MM SCREEN = 1.35

CONTINGENCY TABLE

TOTAL NUMBER OF EPHEMEROPTERA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	298.00	.00	38.51	15.25	.00	53.96	.00	.00	405.72
2	.00	7.73	29.86	24.82	.00	.00	93.54	7.75	163.69
3	15.46	30.81	18.15	78.04	61.65	62.38	.00	.00	266.49
4	30.51	.00	.00	.00	.00	.00	.00	31.17	61.68
5	.00	.00	.00	.00	7.78	31.09	.00	.00	38.87
TOTALS	344.0	38.5	86.5	118.1	69.4	147.4	93.5	38.9	936.44

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 936.44

MEAN FOR 9.5MM SCREEN = 23.41

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA PUPAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	135.46	84.16	169.44	45.76	23.25	26.98	.00	93.50	578.55
2	124.07	440.50	298.55	372.24	523.98	676.43	342.98	108.46	2887.23
3	247.33	462.16	84.70	265.33	893.86	405.50	1310.41	1375.84	5045.13
4	106.80	395.44	208.64	822.00	684.82	123.95	728.15	342.84	3412.63
5	.00	12.32	7.73	.00	38.89	341.98	683.68	654.51	1739.11
TOTALS	613.6	1394.6	769.1	1505.3	2164.8	1574.8	3065.2	2575.2	13662.65

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 13662.65

MEAN FOR 9.5MM SCREEN = 341.57

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA ADULT PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	27.09	24.75	46.21	7.63	.00	80.94	.00	.00	186.62
2	.00	30.91	.00	.00	.00	.00	31.18	.00	62.09
3	.00	7.70	6.05	.00	.00	.00	.00	.00	13.75
4	.00	23.26	7.73	.00	62.26	.00	.00	31.17	124.41
5	.00	.00	.00	.00	38.89	62.18	.00	62.33	163.40
TOTALS	27.1	86.6	60.0	7.6	101.1	143.1	31.2	93.5	550.28

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 550.28

MEAN FOR 9.5MM SCREEN = 13.76

CONTINGENCY TABLE

TOTAL NUMBER OF DIPTERA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

BLOCK	DAY OF STUDY 1	2	3	4	5	6	7	8	TOTALS
1	189.64	143.57	231.06	91.51	23.25	188.86	245.95	155.84	1269.67
2	124.07	525.51	328.41	397.06	554.81	730.54	436.52	116.21	3213.13
3	262.78	477.57	127.05	312.16	924.68	436.69	1310.41	1391.39	5242.73
4	114.42	426.46	216.37	853.02	747.07	123.95	782.09	436.34	3699.72
5	.00	12.32	7.73	23.26	116.66	404.16	714.76	748.01	2026.90
TOTALS	690.9	1585.4	910.6	1677.0	2366.5	1884.2	3489.7	2847.8	15452.14

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 15452.14

MEAN FOR 9.5MM SCREEN = 386.30

CONTINGENCY TABLE

TOTAL NUMBER OF ZYGOPTERA TOTAL PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	27.06	.00	.00	27.06
3	.00	.00	.00	.00	.00	.00	.00	7.77	7.77
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	.0	27.1	.0	7.8	34.83

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 34.83

MEAN FOR 9.5MM SCREEN = .87

CONTINGENCY TABLE

TOTAL NUMBER OF HYDRACARINA ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	15.46	.00	.00	.00	.00	62.36	.00	77.82
3	.00	7.70	42.35	54.63	.00	.00	.00	15.55	120.23
4	.00	.00	30.91	31.02	.00	.00	26.97	.00	88.90
5	31.31	.00	.00	7.75	62.22	.00	31.08	.00	132.35
TOTALS	31.3	23.2	73.3	93.4	62.2	.0	120.4	15.5	419.29

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 419.29

MEAN FOR 9.5MM SCREEN = 10.48

CONTINGENCY TABLE

TOTAL NUMBER OF AMPHIPODA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	3359.31	2138.66	492.93	1212.53	356.57	5611.73	6517.58	2898.56	22587.85
2	1008.09	1221.05	1134.49	1116.73	2989.79	5194.98	2338.48	472.60	15476.22
3	564.21	1024.46	429.56	952.07	893.86	1902.72	2371.21	590.76	8728.86
4	602.63	519.50	479.10	884.04	1680.91	1797.21	863.00	342.84	7169.22
5	12.52	24.65	7.73	255.82	528.85	621.78	2827.96	1402.53	5681.84
TOTALS	5546.8	4928.3	2543.8	4421.2	6450.0	15128.4	14918.2	5707.3	59643.98

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 59643.98

MEAN FOR 9.5MM SCREEN = 1491.10

CONTINGENCY TABLE

TOTAL NUMBER OF ISOPODA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	162.55	232.68	92.42	160.14	38.76	80.94	.00	31.17	798.66
2	.00	92.74	.00	148.90	61.65	81.17	124.72	7.75	516.92
3	23.19	15.41	42.35	31.22	61.65	31.19	124.80	.00	329.80
4	122.05	23.26	23.18	31.02	62.26	.00	53.94	.00	315.71
5	18.79	18.49	7.73	7.75	15.55	.00	155.38	31.17	254.86
TOTALS	326.6	382.6	165.7	379.0	239.9	193.3	458.8	70.1	
									2215.93

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 2215.93

MEAN FOR 9.5MM SCREEN = 55.40

CONTINGENCY TABLE

TOTAL NUMBER OF DECOPODA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	62.26	.00	.00	.00	62.26
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	62.3	.0	.0	.0	62.26

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 62.26

MEAN FOR 9.5MM SCREEN = 1.56

CONTINGENCY TABLE

TOTAL NUMBER OF MYSIDACEA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR 9.5MM SCREEN

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	24.75	69.32	76.26	7.75	80.94	368.92	31.17	659.11
2	31.02	38.64	89.57	24.82	61.65	270.57	31.18	.00	547.44
3	85.02	77.03	.00	54.63	61.65	.00	62.40	.00	340.72
4	.00	31.01	7.73	.00	62.26	123.95	53.94	.00	278.88
5	.00	.00	.00	.00	23.33	62.18	62.15	62.33	210.00
TOTALS	116.0	171.4	166.6	155.7	216.6	537.6	578.6	93.5	2036.14

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 2036.14

MEAN FOR 9.5MM SCREEN = 50.90

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                              CONTINGENCY TABLE
                     TOTAL NUMBER OF   ELOPS SAURUS             POSTLARVAE PER 100 CUBIC METERS
                     ACTUAL DENSITIES
                     BY DAY AND BLOCK FOR TOWS
                     SEMINOLE ELECTRIC COOPERATIVE, INC
                                    INTAKE STUDIES
                                          DAY OF STUDY

BLOCK
                                                                      TOTALS
               1      2      3      4      5      6      7      8
   1          .00    .00    .61    .00    .00    .00    .00    .00          .61
   2          .00    .00    .00    .00    .00    .00    .00    .00          .00
   3          .00    .00    .00    .68    .00    .69    .00    .00         1.37
   4          .00    .00    .00    .00    .00    .00    .00    .00          .00
   5          .00    .00    .00    .00    .00    .67    .00    .00          .67

------------------------------------------------------------------------------------
    TOTALS        .0     .0     .6     .7     .0    1.4     .0     .0
                                                                               2.65

                                 OTHER TOTALS
          TOTAL FOR TOWS =        2.65             MEAN FOR TOWS =           .07
```

```
                                  CONTINGENCY TABLE
                              TOTAL NUMBER OF   ELOPS SAURUS           ALL LARVAE PER 100 CUBIC METERS
                              ACTUAL DENSITIES
                              BY DAY AND BLOCK FOR TOWS
                              SEMINOLE ELECTRIC COOPERATIVE, INC
                                        INTAKE STUDIES
                                              DAY OF STUDY

BLOCK
                                                                              TOTALS
                  1       2       3       4       5       6       7       8
  1
                 .00     .00     .61     .00     .00     .00     .00     .00          .61
  2
                 .00     .00     .00     .00     .00     .00     .00     .00          .00
  3
                 .00     .00     .00     .68     .00     .69     .00     .00         1.37
  4
                 .00     .00     .00     .00     .00     .00     .00     .00          .00
  5
                 .00     .00     .00     .00     .00     .67     .00     .00          .67
-----------------------------------------------------------------------------------------------
    TOTALS
                    .0      .0      .6      .7      .0     1.4      .0      .0
                                                                                      2.65

                                  OTHER TOTALS
               TOTAL FOR TOWS =                2.65          MEAN FOR TOWS =              .07
```

```
                              CONTINGENCY TABLE
                         TOTAL NUMBER OF   ANGUILLA ROSTRATA          ADULTS     PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR TOWS
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                  INTAKE STUDIES
                                        DAY OF STUDY

BLOCK
                                                                                    TOTALS
                 1        2        3        4        5        6        7        8
*DEL*
  1             .00      .00      .00      .00      .00      .00      .00      .00            .00
  2             .00      .00      .00      .59      .00      .00      .00      .00            .59
  3             .00      .00      .00      .00      .00      .00      .00      .00            .00
  4             .00      .00      .00      .00      .00      .00      .00      .00            .00
  5             .00      .00      .00      .00      .00      .00      .00      .00            .00

------------------------------------------------------------------------------------------------------
    TOTALS          .0       .0       .0       .6       .0       .0       .0       .0
                                                                                                  .59

                                  OTHER TOTALS
              TOTAL FOR TOWS =                .59              MEAN FOR TOWS =              .01
```

CONTINGENCY TABLE

TOTAL NUMBER OF DOROSOMA CEPEDIANUM POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.69	.00	.00	.00	.69
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	.7	.0	.0	.0	.69

OTHER TOTALS

TOTAL FOR TOWS = .69

MEAN FOR TOWS = .02

CONTINGENCY TABLE

TOTAL NUMBER OF DOROSOMA CEPEDIANUM PROLARVAE PER 100 CUBIC METERS
ACTUAL DENSITIES
BY DAY AND BLOCK FOR TOWS
SEMINOLE ELECTRIC COOPERATIVE, INC
INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.58	.00	.00	.00	.00	.00	.00	.00	.58
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	2.08	.00	.00	2.08
4	.00	.00	.00	.00	.76	1.30	.00	.00	2.06
5	.72	.00	.00	.00	.00	.00	.00	.00	.72
TOTALS	1.3	.0	.0	.0	.8	3.4	.0	.0	5.43

OTHER TOTALS

TOTAL FOR TOWS = 5.43

MEAN FOR TOWS = .14

```
                              CONTINGENCY TABLE
                         TOTAL NUMBER OF   DOROSOMA CEPEDIANUM         ALL LARVAE PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR TOWS
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                 INTAKE STUDIES
                                      DAY OF STUDY

BLOCK
                                                                                 TOTALS
                 1        2        3        4        5        6        7        8
  1             .58      .00      .00      .00      .69      .00      .00      .00            1.27
  2             .00      .00      .00      .00      .00      .00      .00      .00             .00
  3             .00      .00      .00      .00      .00     2.08      .00      .00            2.08
  4             .00      .00      .00      .00      .76     1.30      .00      .00            2.06
  5             .72      .00      .00      .00      .00      .00      .00      .00             .72
----------------------------------------------------------------------------------------------------
    TOTALS         1.3       .0       .0       .0      1.5      3.4       .0       .0
                                                                                               6.13

                              OTHER TOTALS
         TOTAL FOR TOWS =          6.13                MEAN FOR TOWS =                  .15
```

```
                                   CONTINGENCY TABLE
                             TOTAL NUMBER OF   DOROSOMA PETENENSE          JUVENILES  PER 100 CUBIC METERS
                             ACTUAL DENSITIES
                             BY DAY AND BLOCK FOR TOWS
                             SEMINOLE ELECTRIC COOPERATIVE, INC
                                      INTAKE STUDIES
                                            DAY OF STUDY

BLOCK

                                                                                    TOTALS
                  1        2        3        4        5        6        7        8
   1            .00      .00      .00      .00      .00      .00      .00      .00             .00
   2            .00      .00      .00      .00      .00      .00      .00      .00             .00
   3            .00      .00      .72      .00      .00      .00      .00      .00             .72
   4            .00      .00      .00      .00      .00      .00      .00      .00             .00
   5            .00      .00      .00      .00      .00      .00      .00      .00             .00
-----------------------------------------------------------------------------------------------------
     TOTALS        .0       .0       .7       .0       .0       .0       .0       .0
                                                                                                 .72

                                   OTHER TOTALS
              TOTAL FOR TOWS =                .72              MEAN FOR TOWS =                .02
```

CONTINGENCY TABLE

TOTAL NUMBER OF DOROSOMA PETENENSE ADULTS PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.68	.00	.00	.00	.00	.68
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.7	.0	.0	.0	.0	.68

OTHER TOTALS

TOTAL FOR TOWS = .68

MEAN FOR TOWS = .02

CONTINGENCY TABLE

TOTAL NUMBER OF DOROSOMA SP. POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.69	.00	.00	.00	.69
2	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	.7	.0	.0	.0	.69

OTHER TOTALS

TOTAL FOR TOWS = .69

MEAN FOR TOWS = .02

```
                                        CONTINGENCY TABLE
                                TOTAL NUMBER OF   DOROSOMA SP.                   ALL LARVAE PER 100 CUBIC METERS
                                ACTUAL DENSITIES
                                BY DAY AND BLOCK FOR TOWS
                                SEMINOLE ELECTRIC COOPERATIVE, INC
                                           INTAKE STUDIES
                                                  DAY OF STUDY
BLOCK
                                                                             TOTALS
                   1       2       3       4       5       6       7       8
  1               .00     .00     .00     .00     .69     .00     .00     .00          .69
  2               .00     .00     .00     .00     .00     .00     .00     .00          .00
  3               .00     .00     .00     .00     .00     .00     .00     .00          .00
  4               .00     .00     .00     .00     .00     .00     .00     .00          .00
  5               .00     .00     .00     .00     .00     .00     .00     .00          .00
------------------------------------------------------------------------------------------
     TOTALS           .0      .0      .0      .0      .7      .0      .0      .0
                                                                                        .69

                                        OTHER TOTALS
                  TOTAL FOR TOWS =           .69             MEAN FOR TOWS =           .02
```

```
                              CONTINGENCY TABLE
                         TOTAL NUMBER OF   ANCHOA MITCHILLI          JUVENILES  PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR TOWS
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                     INTAKE STUDIES
                                          DAY OF STUDY
BLOCK

                                                                            TOTALS
                 1        2        3        4        5        6        7        8
   1            .00      .00      .00      .00      .00      .00      .00      .69          .69
   2            .00      .00      .00      .00      .00     3.12      .00      .00         3.12
   3            .00      .00      .00      .68     2.70      .69      .00     1.42         5.50
   4            .00      .00      .00      .00      .76      .00     3.14      .00         3.90
   5            .00      .00      .00      .00      .00      .00      .00      .00          .00

------------------------------------------------------------------------------------------------
     TOTALS        .0       .0       .0       .7      3.5      3.8      3.1      2.1
                                                                                          13.21

                                  OTHER TOTALS
              TOTAL FOR TOWS =           13.21               MEAN FOR TOWS =             .33
```

CONTINGENCY TABLE

TOTAL NUMBER OF ANCHOA MITCHILLI ADULTS PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

BLOCK	DAY OF STUDY 1	2	3	4	5	6	7	8	TOTALS
1	1.74	.00	1.82	1.89	2.08	1.34	.00	.00	8.86
2	3.60	.86	.93	.00	1.39	.00	.00	.69	7.47
3	.55	3.04	6.49	2.04	.00	2.77	.00	.00	14.89
4	1.95	3.08	5.91	4.38	3.03	.00	3.14	1.37	22.86
5	.00	.00	.00	.68	.00	2.69	.00	.00	3.37
TOTALS	7.8	7.0	15.1	9.0	6.5	6.8	3.1	2.1	57.45

OTHER TOTALS

TOTAL FOR TOWS = 57.45

MEAN FOR TOWS = 1.44

```
                              CONTINGENCY TABLE
                      TOTAL NUMBER OF   ANCHOA MITCHILLI          ALL LARVAE PER 100 CUBIC METERS
                      ACTUAL DENSITIES
                      BY DAY AND BLOCK FOR TOWS
                      SEMINOLE ELECTRIC COOPERATIVE, INC
                                   INTAKE STUDIES
                                          DAY OF STUDY

BLOCK

                                                                       TOTALS
                  1        2        3        4        5        6        7        8
   1             .58      .00      .00      .63      .00      .00      .00      .00           1.21
   2             .90      .00      .00      .00      .00      .00      .00      .00            .90
   3             .00      .76      .00      .68      .00      .69      .00      .71           2.84
   4             .00      .77      .00     1.46      .00      .65      .00      .00           2.88
   5             .00      .00      .00      .00      .00      .00      .00      .00            .00

-------------------------------------------------------------------------------------------------------

      TOTALS          1.5      1.5       .0      2.8       .0      1.3       .0       .7

                                                                                                7.83

                                   OTHER TOTALS
             TOTAL FOR TOWS =          7.83                MEAN FOR TOWS =            .20
```

```
                         CONTINGENCY TABLE
                     TOTAL NUMBER OF   NOTEMIGONUS CRYSOLEUCAS     PROLARVAE  PER 100 CUBIC METERS
                     ACTUAL DENSITIES
                     BY DAY AND BLOCK FOR TOWS
                     SEMINOLE ELECTRIC COOPERATIVE, INC
                               INTAKE STUDIES
                                     DAY OF STUDY

BLOCK

                                                                                     TOTALS
                 1        2        3        4        5        6        7        8
  1             .00      .00      .00      .00      .00      .00      .00      .00          .00
  2             .00      .00      .00      .00      .00      .00      .67      .00          .67
  3             .00      .00      .00      .00      .00      .00      .00      .00          .00
  4             .00      .00      .00      .00      .00      .00      .00      .00          .00
  5             .00      .00      .00      .00      .00      .00      .00      .00          .00

------------------------------------------------------------------------------------------------
    TOTALS          .0       .0       .0       .0       .0       .0       .7       .0
                                                                                              .67

                                    OTHER TOTALS
              TOTAL FOR TOWS =          .67              MEAN FOR TOWS =              .02
```

```
                        CONTINGENCY TABLE
                    TOTAL NUMBER OF   NOTEMIGONUS CRYSOLEUCAS      ALL LARVAE PER 100 CUBIC METERS
                    ACTUAL DENSITIES
                    BY DAY AND BLOCK FOR TOWS
                    SEMINOLE ELECTRIC COOPERATIVE, INC
                              INTAKE STUDIES
                                    DAY OF STUDY

BLOCK
                                                                      TOTALS
            1       2       3       4       5       6       7       8
  1        .00     .00     .00     .00     .00     .00     .00     .00         .00
  2        .00     .00     .00     .00     .00     .00     .67     .00         .67
  3        .00     .00     .00     .00     .00     .00     .00     .00         .00
  4        .00     .00     .00     .00     .00     .00     .00     .00         .00
  5        .00     .00     .00     .00     .00     .00     .00     .00         .00
--------------------------------------------------------------------------------------
    TOTALS     .0      .0      .0      .0      .0      .0      .7      .0
                                                                                .67

                              OTHER TOTALS
          TOTAL FOR TOWS =          .67              MEAN FOR TOWS =              .02
```

CONTINGENCY TABLE

TOTAL NUMBER OF STRONGYLURA MARINA PROLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	1.39	.00	.00	.00	1.39
3	.00	.00	.00	.00	.00	.69	.00	.00	.69
4	.00	.00	.00	.00	.00	.65	.00	.00	.65
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.0	.0	1.4	1.3	.0	.0	2.73

OTHER TOTALS

TOTAL FOR TOWS = 2.73

MEAN FOR TOWS = .07

```
                              CONTINGENCY TABLE
                        TOTAL NUMBER OF   STRONGYLURA MARINA          POSTLARVAE PER 100 CUBIC METERS
                        ACTUAL DENSITIES
                        BY DAY AND BLOCK FOR TOWS
                        SEMINOLE ELECTRIC COOPERATIVE, INC
                                     INTAKE STUDIES
                                                DAY OF STUDY

BLOCK
                                                                                      TOTALS
                 1         2         3         4         5         6         7         8
  1             .00       .00       .00       .00       .00       .00       .00       .00          .00
  2             .00       .00       .46       .00       .00      3.12       .67       .00         4.25
  3             .00       .00       .00       .68       .00       .00       .00       .00          .68
  4             .00       .00       .00       .00       .00       .00       .00       .00          .00
  5             .00       .00       .00       .00       .00       .00       .00       .00          .00

------------------------------------------------------------------------------------------------------------

    TOTALS         .0        .0        .5        .7        .0       3.1        .7        .0
                                                                                                  4.93

                                     OTHER TOTALS
              TOTAL FOR TOWS =            4.93              MEAN FOR TOWS =                .12
```

CONTINGENCY TABLE

TOTAL NUMBER OF STRONGYLURA MARINA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.46	.00	1.39	3.12	.67	.00	5.64
3	.00	.00	.00	.68	.00	.69	.00	.00	1.37
4	.00	.00	.00	.00	.00	.65	.00	.00	.65
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.0	.5	.7	1.4	4.5	.7	.0	7.66

OTHER TOTALS

TOTAL FOR TOWS = 7.66

MEAN FOR TOWS = .19

CONTINGENCY TABLE

TOTAL NUMBER OF LUCANIA PARVA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

BLOCK	DAY OF STUDY 1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.67	.00	.00	.67
2	.00	.00	.00	.00	1.39	3.12	.67	.00	5.18
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.74	.00	.00	.00	.74
TOTALS	.0	.0	.0	.0	2.1	3.8	.7	.0	6.59

OTHER TOTALS

TOTAL FOR TOWS = 6.59

MEAN FOR TOWS = .16

```
                    CONTINGENCY TABLE
                 TOTAL NUMBER OF   LUCANIA PARVA            ADULTS     PER 100 CUBIC METERS
                 ACTUAL DENSITIES
                 BY DAY AND BLOCK FOR TOWS
                 SEMINOLE ELECTRIC COOPERATIVE, INC
                          INTAKE STUDIES
                                 DAY OF STUDY

BLOCK
                                                                     TOTALS
             1      2      3      4      5      6      7      8
  1        .00    .00    .00    .00    .00    .67    .00    .00         .67
  2        .00    .00    .00    .00    .00    .00    .00    .00         .00
  3        .00    .00    .00    .00    .00    .00    .00    .00         .00
  4        .00    .00    .00    .00    .76    .00    .00    .00         .76
  5        .00    .00    .00    .00    .00    .00   2.70    .00        2.70

---------------------------------------------------------------------------------
    TOTALS      .0     .0     .0     .0     .8     .7    2.7     .0
                                                                        4.12

                              OTHER TOTALS
        TOTAL FOR TOWS =          4.12            MEAN FOR TOWS =          .10
```

CONTINGENCY TABLE

TOTAL NUMBER OF LUCANIA PARVA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

BLOCK	DAY OF STUDY								TOTALS
	1	2	3	4	5	6	7	8	
1	.00	.00	.00	.00	.00	.67	.00	.00	.67
2	.00	.00	.00	.00	1.39	3.12	.67	.00	5.18
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.74	.00	.00	.00	.74
TOTALS	.0	.0	.0	.0	2.1	3.8	.7	.0	6.59

OTHER TOTALS

TOTAL FOR TOWS = 6.59

MEAN FOR TOWS = .16

```
                                      CONTINGENCY TABLE
                              TOTAL NUMBER OF   MEMBRAS MARTINICA          PROLARVAE  PER 100 CUBIC METERS
                              ACTUAL DENSITIES
                              BY DAY AND BLOCK FOR TOWS
                              SEMINOLE ELECTRIC COOPERATIVE, INC
                                         INTAKE STUDIES
                                               DAY OF STUDY

BLOCK
                                                                                    TOTALS
                    1        2        3        4        5        6        7        8
    1             .00      .00      .00      .00      .00     2.68      .00      .00           2.68
    2             .00      .00     1.85      .59     2.08      .00     4.67     3.46          12.66
    3             .00      .00      .00     2.04      .00     2.77      .00      .00           4.81
    4             .00      .00      .00     1.46     2.27      .65      .00      .00           4.38
    5             .00      .00      .00      .68     2.22      .67      .00      .70           4.27
-----------------------------------------------------------------------------------------------------
      TOTALS          .0       .0      1.9      4.8      6.6      6.8      4.7      4.2
                                                                                                28.80

                                         OTHER TOTALS
                TOTAL FOR TOWS =        28.80                MEAN FOR TOWS =                 .72
```

```
                        CONTINGENCY TABLE
                   TOTAL NUMBER OF   MEMBRAS MARTINICA          POSTLARVAE PER 100 CUBIC METERS
                   ACTUAL DENSITIES
                   BY DAY AND BLOCK FOR TOWS
                   SEMINOLE ELECTRIC COOPERATIVE, INC
                               INTAKE STUDIES
                                     DAY OF STUDY

BLOCK
                                                                        TOTALS
              1       2       3       4       5       6       7       8
    1        .00     .71     .00     .00     .00     .00     .00     .00         .71
    2        .00     .00    1.85     .00     .00     .00     .00     .00        1.85
    3        .00     .00     .00     .00     .00     .00     .00     .00         .00
    4        .00     .77     .00     .73    2.27     .65     .00     .00        4.42
    5        .00     .00     .69     .00     .00     .00     .00     .00         .69

------------------------------------------------------------------------------------------
     TOTALS        .0     1.5     2.5      .7     2.3      .7      .0      .0
                                                                                  7.68

                             OTHER TOTALS
          TOTAL FOR TOWS =            7.68             MEAN FOR TOWS =             .19
```

CONTINGENCY TABLE

TOTAL NUMBER OF MEMBRAS MARTINICA — ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.71	.00	.00	.00	2.68	.00	.00	3.40
2	.00	.00	3.71	.59	2.08	.00	4.67	3.46	14.51
3	.00	.00	.00	2.04	.00	2.77	.00	.00	4.81
4	.00	.77	.00	2.19	4.55	1.30	.00	.00	8.81
5	.00	.00	.69	.68	2.22	.67	.00	.70	4.97
TOTALS	.0	1.5	4.4	5.5	8.9	7.4	4.7	4.2	
									36.49

OTHER TOTALS

TOTAL FOR TOWS = 36.49

MEAN FOR TOWS = .91

```
                                   CONTINGENCY TABLE
                         TOTAL NUMBER OF   MENIDIA BERYLLINA          PROLARVAE  PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR TOWS
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                INTAKE STUDIES
                                          DAY OF STUDY

BLOCK
                                                                         TOTALS
              1        2        3        4        5        6        7        8
   1        1.16     6.43     6.05      .00     9.01     1.34     2.62      .00            26.61
   2        1.80      .00     4.17      .00    11.80      .00    14.00     3.46            35.23
   3         .00      .00      .00    10.86    35.16    13.87     5.71     4.26            69.86
   4         .00      .00      .00     1.46     6.82    18.86     3.14      .00            30.28
   5        1.43      .64      .00      .68      .74     2.01    22.92      .00            28.43

-------------------------------------------------------------------------------------------------
     TOTALS      4.4      7.1     10.2     13.0     63.5     36.1     48.4      7.7
                                                                                          190.41

                                 OTHER TOTALS
         TOTAL FOR TOWS =         190.41              MEAN FOR TOWS =               4.76
```

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.61	.00	.00	.00	.00	2.06	2.67
2	.00	.00	.46	.00	.00	.00	2.67	.00	3.13
3	.00	.00	1.44	.68	16.23	2.08	5.71	.00	26.14
4	.65	1.54	.74	.00	25.02	7.80	.00	.68	36.43
5	.00	.00	1.38	.00	3.70	.00	13.48	.00	18.57
TOTALS	.6	1.5	4.6	.7	44.9	9.9	21.9	2.7	86.94

OTHER TOTALS

TOTAL FOR TOWS = 86.94

MEAN FOR TOWS = 2.17

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA

ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

	DAY OF STUDY								
BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	1.16	6.43	6.66	.00	9.01	1.34	3.27	2.06	29.93
2	1.80	.00	4.64	.00	11.80	.00	16.66	3.46	38.36
3	.00	.00	1.44	11.53	51.39	15.95	11.42	4.26	95.99
4	.65	1.54	.74	1.46	31.84	26.66	3.14	.68	66.72
5	1.43	.64	2.08	.68	4.44	2.01	37.75	.00	49.04
TOTALS	5.0	8.6	15.5	13.7	108.5	46.0	72.2	10.5	280.04

OTHER TOTALS

TOTAL FOR 9.5MM SCREEN = 280.04

MEAN FOR TOWS = 7.00

CONTINGENCY TABLE

TOTAL NUMBER OF MENIDIA BERYLLINA JUVENILES PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.86	.00	.00	.00	.00	.00	.00	.86
3	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.0	.9	.0	.0	.0	.0	.0	.0	.86

OTHER TOTALS

TOTAL FOR TOWS = .86

MEAN FOR TOWS = .02

```
                              CONTINGENCY TABLE
                        TOTAL NUMBER OF   MENIDIA BERYLLINA          ADULTS     PER 100 CUBIC METERS
                        ACTUAL DENSITIES
                        BY DAY AND BLOCK FOR TOWS
                        SEMINOLE ELECTRIC COOPERATIVE, INC
                                   INTAKE STUDIES
                                          DAY OF STUDY

BLOCK
                                                                          TOTALS
                1      2      3      4      5      6      7      8
  1            .00    .00    .00    .00    .00    .00    .00    .00           .00
  2            .00    .00    .00    .00    .00    .00    .00    .00           .00
  3            .00    .00    .00    .68    .00    .00    .00    .00           .68
  4            .00    .00    .00    .00    .76    .00    .00    .00           .76
  5            .00    .00    .00    .00    .00    .00    .00    .00           .00

-------------------------------------------------------------------------------------
    TOTALS        .0     .0     .0     .7     .8     .0     .0     .0
                                                                                1.44

                                 OTHER TOTALS
            TOTAL FOR TOWS =           1.44            MEAN FOR TOWS =            .04
```

```
                              CONTINGENCY TABLE
                         TOTAL NUMBER OF   LEIOSTOMUS XANTHURUS        JUVENILES  PER 100 CUBIC METERS
                         ACTUAL DENSITIES
                         BY DAY AND BLOCK FOR TOWS
                         SEMINOLE ELECTRIC COOPERATIVE, INC
                                 INTAKE STUDIES
                                      DAY OF STUDY

BLOCK
                                                                            TOTALS
                1       2       3       4       5       6       7       8
   1          .00     .00     .00     .00     .00     .67     .00     .00             .67
   2          .00     .00     .00     .00     .00     .00     .00     .00             .00
   3          .00     .00     .00     .00     .00     .00     .00     .00             .00
   4          .00     .00     .00     .00     .00     .00     .00     .00             .00
   5          .00     .00     .00     .00     .00     .00     .00     .00             .00

------------------------------------------------------------------------------------------
    TOTALS        .0      .0      .0      .0      .0      .7      .0      .0
                                                                                       .67

                                OTHER TOTALS
              TOTAL FOR TOWS =            .67            MEAN FOR TOWS =             .02
```

CONTINGENCY TABLE

TOTAL NUMBER OF MICROPOGON UNDULATUS POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	2.32	7.15	8.47	6.94	18.02	7.37	.00	.00	50.27
2	14.41	.00	5.10	.00	13.88	.00	8.00	.00	41.39
3	3.27	4.56	23.07	19.68	13.52	3.47	22.83	2.84	93.25
4	10.39	4.61	4.44	12.40	34.11	7.80	3.14	2.05	78.96
5	.00	.00	.00	.00	3.70	.67	6.74	.70	11.82
TOTALS	30.4	16.3	41.1	39.0	83.2	19.3	40.7	5.6	275.68

OTHER TOTALS

TOTAL FOR TOWS = 275.68

MEAN FOR TOWS = 6.89

```
                         CONTINGENCY TABLE
                    TOTAL NUMBER OF   MICROPOGON UNDULATUS        JUVENILES  PER 100 CUBIC METERS
                    ACTUAL DENSITIES
                    BY DAY AND BLOCK FOR TOWS
                    SEMINOLE ELECTRIC COOPERATIVE, INC
                              INTAKE STUDIES
                                   DAY OF STUDY

BLOCK
                                                                               TOTALS
               1        2        3        4        5        6        7        8
   1         .00     5.00      .00      .00      .69      .67      .00      .69          7.06
   2         .00    13.80     2.32     1.19     5.55    21.85     1.33      .00         46.04
   3         .00     1.52     5.05     2.04      .00      .00     4.28      .00         12.88
   4        1.30      .00     2.22     6.56     3.79      .65      .00      .00         14.52
   5         .00      .00      .00      .00      .00     1.34     1.35      .70          3.39

-----------------------------------------------------------------------------------------------
     TOTALS       1.3     20.3      9.6      9.8     10.0     24.5      7.0      1.4
                                                                                         83.89

                              OTHER TOTALS
            TOTAL FOR TOWS =          83.89           MEAN FOR TOWS =               2.10
```

CONTINGENCY TABLE

TOTAL NUMBER OF MICROPOGON UNDULATUS ALL LARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	2.32	7.15	8.47	6.94	18.02	7.37	.00	.00	50.27
2	14.41	.00	5.10	.00	13.88	.00	8.00	.00	41.39
3	3.27	4.56	23.07	19.68	13.52	3.47	22.83	2.84	93.25
4	10.39	4.61	4.44	12.40	34.11	7.80	3.14	2.05	78.96
5	.00	.00	.00	.00	3.70	.67	6.74	.70	11.82
TOTALS	30.4	16.3	41.1	39.0	83.2	19.3	40.7	5.6	275.68

OTHER TOTALS

TOTAL FOR TOWS = 275.68

MEAN FOR TOWS = 6.89

CONTINGENCY TABLE

TOTAL NUMBER OF GOBIOSOMA BOSCI POSTLARVAE PER 100 CUBIC METERS

ACTUAL DENSITIES

BY DAY AND BLOCK FOR TOWS

SEMINOLE ELECTRIC COOPERATIVE, INC

INTAKE STUDIES

DAY OF STUDY

BLOCK	1	2	3	4	5	6	7	8	TOTALS
1	.00	.00	.00	.00	.00	2.01	.00	.00	2.01
2	.00	.00	.00	.00	.00	.00	2.67	5.54	8.20
3	.00	.00	.00	.00	.00	.69	8.56	2.84	12.10
4	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	1.48	.00	.00	.00	1.48
TOTALS	.0	.0	.0	.0	1.5	2.7	11.2	8.4	23.79

OTHER TOTALS

TOTAL FOR TOWS = 23.79

MEAN FOR TOWS = .59

```
                                  CONTINGENCY TABLE
                        TOTAL NUMBER OF   GOBIOSOMA BOSCI             ADULTS     PER 100 CUBIC METERS
                        ACTUAL DENSITIES
                        BY DAY AND BLOCK FOR TOWS
                        SEMINOLE ELECTRIC COOPERATIVE, INC
                                         INTAKE STUDIES
                                              DAY OF STUDY

BLOCK
                                                                                  TOTALS
                  1         2         3         4         5         6         7         8
  1              .00       .00       .00       .00       .00       .00       .00       .00             .00
  2              .00       .00       .00       .00       .00       .00       .00       .00             .00
  3              .00       .00       .00       .00       .00       .00       .00       .00             .00
  4              .00       .00       .00       .00       .00       .00      3.14       .00            3.14
  5              .00       .00       .00       .00       .00       .00       .00       .00             .00

-----------------------------------------------------------------------------------------------------------

    TOTALS              .0        .0        .0        .0        .0        .0       3.1        .0
                                                                                                      3.14


                                   OTHER TOTALS
          TOTAL FOR TOWS =         3.14                 MEAN FOR TOWS =                   .08
```

```
                                CONTINGENCY TABLE
                          TOTAL NUMBER OF   GOBIOSOMA BOSCI              ALL LARVAE PER 100 CUBIC METERS
                          ACTUAL DENSITIES
                          BY DAY AND BLOCK FOR TOWS
                          SEMINOLE ELECTRIC COOPERATIVE, INC
                                      INTAKE STUDIES
                                            DAY OF STUDY

BLOCK
                                                                        TOTALS
                 1       2       3       4       5       6       7       8

  1             .00     .00     .00     .00     .00    2.01     .00     .00        2.01
  2             .00     .00     .00     .00    1.39     .00   10.66   13.84       25.89
  3             .00     .00     .00     .00     .00    2.08   12.84    3.55       18.48
  4             .00     .00     .00     .00     .00    1.30     .00    2.05        3.36
  5             .00     .00     .00     .00    2.22     .00    1.35     .00        3.57

-------------------------------------------------------------------------------------------
    TOTALS           .0      .0      .0      .0     3.6     5.4    24.9    19.4

                                                                                  53.30

                                  OTHER TOTALS
             TOTAL FOR TOWS =          53.30              MEAN FOR TOWS =           1.33
```

```
                              CONTINGENCY TABLE
                        TOTAL NUMBER OF   MICROGOBIUS GULOSUS          ADULTS     PER 100 CUBIC METERS
                        ACTUAL DENSITIES
                        BY DAY AND BLOCK FOR TOWS
                        SEMINOLE ELECTRIC COOPERATIVE, INC
                                     INTAKE STUDIES
                                               DAY OF STUDY

BLOCK
                                                                                TOTALS
                1        2        3        4        5        6        7        8
  1            .00      .00      .00      .00      .00      .00      .00      .00           .00
  2            .00      .00      .00      .00      .00      .00      .00      .00           .00
  3            .00      .00      .00      .00     2.70      .00      .00      .00          2.70
  4            .00      .00      .00      .00      .00      .00      .00      .00           .00
  5            .00      .00      .00      .00      .00      .00      .00      .00           .00

------------------------------------------------------------------------------------------------------
    TOTALS         .0       .0       .0       .0      2.7       .0       .0       .0
                                                                                             2.70

                                  OTHER TOTALS
              TOTAL FOR TOWS =              2.70              MEAN FOR TOWS =                 .07
```

```
                                    CONTINGENCY TABLE
                              TOTAL NUMBER OF   CITHARICHTHYS SPILOPTERUS    JUVENILES  PER 100 CUBIC METERS
                              ACTUAL DENSITIES
                              BY DAY AND BLOCK FOR TOWS
                              SEMINOLE ELECTRIC COOPERATIVE, INC
                                        INTAKE STUDIES
                                              DAY OF STUDY

BLOCK

                                                                                  TOTALS
                   1       2       3       4       5       6       7       8
  1               .00     .00     .00     .00     .00     .00     .00     .00          .00
  2               .00     .00     .00     .00     .00     .00     .00     .00          .00
  3               .00    1.52     .72     .00     .00     .00     .00     .00         2.24
  4               .00     .00     .00     .00     .00     .00     .00     .00          .00
  5               .00     .00     .00     .00     .00     .00     .00     .00          .00

-----------------------------------------------------------------------------------------------

    TOTALS              .0     1.5      .7      .0      .0      .0      .0      .0
                                                                                        2.24

                                      OTHER TOTALS
                TOTAL FOR TOWS =          2.24              MEAN FOR TOWS =              .06
```

APPENDIX C

RESULTS OF PHASE III STUDIES

TABLE C-1

BIOFOULING - ENTRAINMENT MONITORING
(Densities for fish life stages as numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 7, 1979

Species	Life Stages*	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
ATHERINIDAE					
Menidia beryllina	E	3.92	1.31	10.24	0.98
GOBIIDAE	L	3.92		99.00	12.97
Unidentified	L	10.44	5.22	99.00	1.30
TOTALS		18.28	6.53	218.48	15.91

---

*E - Egg

L - Larva

J - Juvenile

A - Adult

TABLE C-1 (Continued)
NIGHT - JUNE 7, 1979

Species	Life Stages	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
CLUPEIDAE					
Alosa aestivalis	J				1.88
ENGRAULIDAE					
Lucania parva	L	1.31			
Menidia beryllina	E				0.32
	L				7.20
	J				2.20
GOBIIDAE	L	13.05		379.82	381.45
Gobiosoma bosci	L				28.64
	J				0.95
Microgobius gulosus	L				1.56
Unidentified	L	56.13	48.29	203.62	1.90
TOTALS		70.49	48.29	583.44	426.10

TABLE C-2

BIOFOULING - ENTRAINMENT MONITORING
(Densities for fish life stages as numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 23, 1979

Species	Life Stages*	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
ATHERINIDAE					
Micropterus salmoides	J			0.84	
GOBIIDAE	L			4.19	0.99
Microgobius gulosus	L			0.84	—
TOTALS				9.22	0.99

---

*E - Egg

L - Larva

J - Juvenile

A - Adult

TABLE C-2 (Continued)
NIGHT - JUNE 23, 1979

Species	Life Stage	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
CLUPEIDAE	L				1.39
Alosa sp.	J				1.52
ENGRAULIDAE					
Anchoa mitchilli	L				206.15
	J				2.78
ATHERINIDAE	L	1.30	3.91		
Menidia beryllina	L		3.91		1.52
GOBIIDAE	L	29.95	74.23	117.47	223.83
Gobiosoma bosci	L		1.30	23.49	141.73
Microgobius gulosus	L		11.72	219.28	42.32
	J				10.61
	A				6.95
Unidentified	L	102.89	76.84	109.64	
TOTALS		134.14	171.91	469.88	638.80

TABLE C-3

BIOFOULING - ENTRAINMENT MONITORING
(Densities for fish life stages as numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JULY 13, 1979

Species	Life Stages*	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
ATHERINIDAE					
Menidia menidia	L				0.29
Lepomis sp.	L			1.30	0.29
GOBIIDAE	L	7.05	2.35	10.42	4.64
Gobiosoma bosci	L				10.98
Unidentified	L	21.14	12.92	24.76	0.87
TOTALS		28.19	15.27	36.48	17.07

*E - Egg
L - Larva
J - Juvenile
A - Adult

TABLE C-3 (Continued)
NIGHT - JULY 12, 1979

Species	Life Stages	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
ENGRAULIDAE	L	1.27	15.27		
Anchoa mitchilli	L			39.16	476.28
Fundulus diaphanus	L		5.09		2.53
ATHERINIDAE	L	10.18	10.18		
Menidia beryllina	L			7.83	7.60
Lepomis sp.	L	10.18	20.36	15.66	17.73
GOBIIDAE	L	337.27	570.18	501.21	686.56
Gobiosoma bosci	L	3.82	45.82	23.49	364.81
	A				2.53
Microgobius gulosus	L		15.27	180.12	83.60
	A				2.53
Unidentified	L	113.27	168.00	156.63	
TOTALS		475.99	850.17	924.10	1644.17

TABLE C-4

BIOFOULING - ENTRAINMENT MONITORING
(Densities for fish life stages as numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - AUGUST 9, 1979

Species	Life Stages*	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
CLUPEIDAE					
Strongylura marina	A				0.31
ATHERINIDAE					
Membras martinica	L	1.30	1.30		
Menidia beryllina	L				2.76
	J	3.90	1.30		1.23
Lepomis sp.	L			10.43	
GOBIIDAE	L	18.18	10.39	662.11	8.32
Gobiosoma bosci	L			203.32	0.62
Microgobius gulosus	L			255.46	0.31
Unidentified	L	7.79	7.79	83.41	0.92
TOTALS		31.17	20.78	1214.73	14.78

---

*E - Egg
L - Larva
J - Juvenile
A - Adult

TABLE C-4 (Continued)
NIGHT - AUGUST 9, 1979

Species	Life Stage	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
CLUPEIDAE					
Dorosoma petenense	J				1.37
ENGRAULIDAE					
Anchoa mitchilli	L				5.40
	A				2.74
Lucania parva	L				2.66
ATHERINIDAE	L	26.10			
Menidia beryllina	L				5.31
Lepomis sp.	L			15.66	5.31
GOBIIDAE	L	151.41	172.29	130.52	142.92
Gobiosoma bosci	L			15.66	2235.06
	J			5.22	40.24
Microgobius gulosus	L	5.22		36.55	262.93
Trinectes maculatus	A				1.29
Unidentified	L	172.29	167.07	146.19	
TOTALS		355.02	339.36	349.80	2713.09

TABLE C-5

BIOFOULING - ENTRAINMENT MONITORING
(Densities for fish life stages as numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - SEPTEMBER 1, 1979

Species	Life Stages*	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
ATHERINIDAE	L				0.30
Menidia beryllina	L				0.29
Lepomis sp.	L			1.30	
Lepomis macrochirus	A			1.30	
GOBIIDAE	L	9.14	14.36	14.31	10.34
Gobiosoma bosci	L	9.14			1.49
Microgobius gulosus	L	1.31			
Unidentified		16.97	11.75	36.43	2.63
TOTALS		36.56	26.11	53.34	15.05

---

*E - Egg
L - Larva
J - Juvenile
A - Adult

TABLE C-5 (Continued)
NIGHT - AUGUST 31, 1979

Species	Life Stage	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)	Tows (average) (No./100m^3)
CLUPEIDAE	L				1.19
ENGRAULIDAE					
Anchoa mitchilli	L				0.30
	A				1.23
Strongylura marina	A				1.23
ATHERINIDAE	L	41.77	3.33		
Membras martinica	L		5.22		34.89
Menidia beryllina	L				9.82
Lepomis sp.	L			10.44	1.23
GOBIIDAE	L	412.46	250.61	469.89	182.07
Gobiosoma bosci	L	177.51	57.43	767.48	1450.55
	A				3.68
Microgobius gulosus	L	5.22		125.30	
	J				38.53
Unidentified		224.50	182.73		5.96
TOTALS		861.46	527.32	1373.11	1730.68

TABLE C-6

BIOFOULING - ENTRAINMENT MONITORING
MACROINVERTEBRATES
(Densities by taxon in numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 7, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m3)	Open Pipe (No./100 m^3)
Insecta*			
Trichoptera			
Psychomyiidae		10.44	
Diptera			
Chironomidae			
Chironominae P		10.44	91.24
Chironominae L		10.44	
Chironomini P	135.75		
Chironomini L	5.22		
Tanypodinae P	31.33	73.09	291.97
Tanypodinae L			36.49
Culicidae			
Chaoborus sp. L			18.25
Chaoborus sp.	10.44		
Zygoptera			
Enallagma sp.			18.25
Arachnoidea			
Hydracarina	5.22	20.88	
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	15.66	20.88	912.41
Oediceratidae			
Monoculodes edwardsi	5.22		72.99
Corophiidae			
Corophium sp.		10.44	
Isopoda			
Idoteidae			
Chiridotea coeca	46.99	52.21	
Sphaeromatidae			
Sphaeroma destructor			36.50
Mysidacea			
Mysidae			
Mysidopsis bigelowi	20.88		857.66

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*Insect life stages are larvae unless otherwise labeled. Life stages as labeled are: L = larvae; P = pupae; A = adult.

TABLE C-6 (Continued)
NIGHT - JUNE 7, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta*			
Ephemeroptera			
Caenidae			
Caenis sp.	10.44	20.88	15.66
Trichoptera			
Psychomyiidae	10.44		
Diptera			
Chironomidae			
Chironominae P	93.98	15.66	109.63
Tanypodinae P	146.19	67.88	62.64
Tanypodinae L	10.44	20.88	15.66
Culicidae			
Chaoborus sp. L	563.89	402.04	751.76
Coleoptera			
Corixidae A			15.66
Arachnoidea			
Hydracarina	20.88		31.32
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	198.40	109.64	297.57
Oediceratidae			
Monoculodes edwardsi	10.44	5.22	46.98
Isopoda			
Idoteidae			
Chiridotea coeca		15.66	15.66
Sphaeromatidae			
Cassidinidea lunifrons			15.66
Sphaeroma destructor	10.44		15.66
Mysidacea			
Mysidae			
Mysidopsis bigelowi	52.21	31.32	1456.53

TABLE C-7

BIOFOULING - ENTRAINMENT MONITORING
MACROINVERTEBRATES
(Densities by taxon in numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JUNE 23, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta*			
Ephemeroptera			
Caenidae			
Caenis sp.	3.91	9.11	
Trichoptera P	2.60		
Hydroptilidae	1.30		
Limnephilidae		2.60	
Psychomyiidae	10.42	10.42	
Diptera			
Chironomidae			
Chironominae L	49.49	63.82	8.38
Chironominae P	1.30	40.37	5.86
Tanypodinae P	58.61	10.42	9.22
Tanypodinae L	10.42	3.90	0.84
Culicidae			
Chaoborus sp. L		1.30	
Coleoptera A	1.30		
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	13.02	16.93	5.86
Oediceratidae			
Monoculodes edwardsi		1.30	
Corophiidae			
Corophium sp.	1.30		
Isopoda			
Idoteidae			
Chiridotea coeca		6.51	
Sphaeromatidae			
Cassidinidea lunifrons			0.84
Mysidacea			
Mysidae			
Mysidopsis bigelowi	3.90	11.72	7.54

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*Insect life stages are larvae unless otherwise labeled. Life stages as labeled are: L = larvae; P = pupae; A = adult.

TABLE C-7 (Continued)
NIGHT - JUNE 23, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta			
Ephemeroptera			
Caenidae			
Caenis sp.	104.19	208.39	250.59
Trichoptera			
Psychomyiidae	41.67	104.19	
Diptera			
Chironomidae			
Chironominae P	62.52	270.90	93.97
Chironominae A	20.84	41.68	
Chironominae L	20.84	41.68	31.32
Tanypodinae P	375.09	500.13	1472.20
Tanypodinae A	20.84	41.68	
Tanypodinae L		166.71	156.62
Culicidae			
Chaoborus sp. L	125.03	145.87	344.56
Chaoborus sp. P	41.68	83.36	344.56
Zygoptera			
Coenagrionidae			
Enallagma sp.		20.84	
Arachnoidea			
Hydracarina	62.52	83.36	93.97
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	896.06	1562.91	1597.49
Oediceratidae			
Monoculodes edwardsi	104.19	62.52	125.29
Corophiidae			
Corophium sp.		20.84	62.65
Isopoda			
Anthuridae			
Cyathura polita	187.54	250.07	93.97
Idoteidae			
Chiridotea coeca	83.36	125.03	31.32
Sphaeromatidae			
Sphaeroma destructor			31.32
Mysidacea			
Mysidae			
Mysidopsis bigelowi	1521.22	1583.74	3602.22

TABLE C-8

BIOFOULING - ENTRAINMENT MONITORING
MACROINVERTEBRATES

(Densities by taxon in numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
DAY - JULY 13, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta*			
Ephemeroptera			
Caenidae			
Caenis sp.	56.38	30.54	
Trichoptera			
Leptoceridae	4.70		
Psychomyiidae	18.79	11.74	
Diptera			
Chironomidae			
Chironominae L	192.65	133.91	5.21
Chironominae P	65.78	32.89	108.14
Tanypodinae L	51.68	25.84	1.30
Tanypodinae P	112.77	70.48	1.30
Arachnoidea			
Hydracarina			2.60
Crustacea			
Nematoda		2.35	
Amphipoda			
Gammaridae			
Gammarus sp.	75.18	14.09	1.30
Oediceratidae			
Monoculodes edwardsi			1.30
Corophiidae			
Corophium sp.		2.35	
Isopoda			
Anthuridae			
Cyathura polita		2.35	
Sphaeromatidae			
Cassidinidea lunifrons			1.30
Mysidacea			
Mysidae			
Mysidopsis bigelowi		4.70	10.42

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*Insect life stages are larvae unless otherwise labeled. Life stages as labeled are: L = larvae; P = pupae; A = adult.

TABLE C-8 (Continued)
NIGHT - JULY 12, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta			
Ephemeroptera			
Caenidae			
Caenis sp. L	1608.76	855.29	1785.43
Caenis sp. P			31.32
Trichoptera			
Psychomyiidae			31.32
Diptera			
Chironomidae			
Chironominae P	61.09	142.55	219.26
Chironominae A	20.36	122.18	
Chironominae L	81.46	101.82	62.65
Tanypodinae P	1201.48	448.01	1033.67
Tanypodinae A		101.82	
Tanypodinae L	142.55	142.55	219.26
Culicidae			
Chaoborus sp. L	61.09	40.73	62.65
Chaoborus sp. P		325.82	
Zygoptera			
Coenagrionidae			
Enallagma sp.			62.65
Arachnoidea			
Hydracarina		40.73	
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	346.19	549.83	313.23
Oedicerātidae			
Monoculodes edwardsi	203.64	122.18	156.62
Corophiidae			
Corophium sp.	20.36	20.36	
Isopoda			
Anthuridae			
Cyathura polita	20.36		93.97
Idoteidae			
Chiridotea coeca	61.09		62.65
Sphaeromatidae			
Cassidinidea lunifrons			62.65
Mysidacea			
Mysidae			
Mysidopsis bigelowi	488.74	916.38	3257.64

TABLE C-9 (Continued)
NIGHT - AUGUST 9, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta*			
Ephemeroptera			
Caenidae			
Caenis sp. P	41.77		
Caenis sp. L	83.54	83.54	104.42
Trichoptera P	41.77		
Psychomyiidae L	20.88	41.77	20.88
Diptera			
Chironomidae			
Chironominae P	355.04	187.96	41.77
Chironominae A	146.19		
Chironominae L	146.19	208.85	20.88
Tanypodinae P	2339.12	2694.16	292.39
Tanypodinae A	41.77		
Tanypodinae L	104.42	83.54	20.88
Culicidae			
Chaoborus sp. L	208.85	125.31	
Coleoptera A	83.54		20.88
Arachnoidea			
Hydracarina	167.08	271.50	41.77
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	1232.21	1190.44	584.78
Oediceratidae			
Monoculodes edwardsi			20.88
Talitridae			
Hyalella sp.	41.77		
Corophiidae			
Corophium sp.	187.96	146.19	
Isopoda			
Anthuridae			
Cyathura polita	20.88		20.88
Sphaeromatidae			
Cassidinidea lunifrons	20.88	20.88	
Mysidacea			
Mysidae			
Mysidopsis bigelowi	1086.02	856.28	16,352.96

TABLE C-10

BIOFOULING - ENTRAINMENT MONITORING
MACROINVERTEBRATES
(Densities by taxon in numbers per 100 meters^3)
SEMINOLE ELECTRIC COOPERATIVE, INC.
NIGHT - AUGUST 31, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Insecta*			
Ephemeroptera			
Caenidae			
Caenis sp. P	20.88	10.44	
Caenis sp. L	62.65	31.33	
Trichoptera	41.77		
Limnephilidae			41.77
Psychomyiidae L			41.77
Diptera			
Chironomidae			
Chironominae P	41.77	135.75	83.54
Chironominae L	20.88	20.88	41.77
Chironominae A	20.88		
Tanypodinae P	689.20	522.12	877.17
Tanypodinae L		20.88	
Culicidae			
Chaoborus sp. P			1420.18
Chaoborus sp. L	83.54	20.88	
Corixidae		10.44	
Arachnoidea			
Hydracarina	146.19	41.77	
Crustacea			
Amphipoda			
Gammaridae			
Gammarus sp.	271.50	93.98	83.54
Oediceratidae			
Monoculodes edwardsi	83.54	20.88	125.31
Corophiidae			
Corophium sp.	83.54		41.77
Isopoda			
Anthuridae			
Cyathura polita		10.44	
Sphaeromatidae			
Sphaeroma destructor		20.88	

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*Insect life stages are larvae unless otherwise labeled. Life stages as labeled are: L = larvae; P = pupae; A = adult.

TABLE C-10 (Continued)
NIGHT - AUGUST 31, 1979

Taxa	1 mm (No./100 m^3)	2 mm (No./100 m^3)	Open Pipe (No./100 m^3)
Mysidacea			
Mysidae			
Mysidopsis bigelowi	2464.43	908.50	6933.82
Mollusca			
Gastropoda			
Ferrissia sp.			83.54

APPENDIX D

LIFE HISTORIES OF IMPORTANT AND VULNERABLE SPECIES

APPENDIX D

LIFE HISTORIES OF IMPORTANT AND VULNERABLE SPECIES

TARPON FAMILY

Ladyfish

Ladyfish (Elops saurus) occur from southern New England to Brazil but are rare north of North Carolina (Jones, et al., 1978). Information reviewed by Jones, et al. (1978) indicates ladyfish apparently spawn offshore, broadcast probably pelagic eggs, and then disperse to inshore areas including upriver to nearby freshwater (0.17 parts per thousand [ppt]) reaches. Stage I larvae (an initial period of larval development) which range from 5.3 to 45 mm standard length (S.L.) have been collected only in offshore waters; Stage II larvae (a middle period of negative growth) 45 to 18 mm S.L. have been collected primarily along oceanic beaches and salt marshes; and Stage III larvae (a second period of positive growth) 18 to 30 mm S.L. near the freshwater transition zone of ponds and marshes. McLane (1955) collected larvae 28 to 30.5 mm S.L. in the St. Johns River at salinities of 0.163 to 0.178 ppt.

FRESHWATER EEL FAMILY

American Eel

The American eel (Anguilla rostrata) is very common in fresh and brackish waters from southwest Greenland to Florida and throughout the Gulf of Mexico (Scott and Crossman, 1973). Most of the eel's adult life is spent in freshwater rivers and lakes and brackish water near river mouths. When mature, from 5 to 18 years of age (ca. 457 mm long), the eels migrate to deep offshore waters (Hardy, 1978). Spawning occurs in the Sargasso Sea area of the Atlantic Ocean northeast of Cuba, probably in midwinter (Bigelow and Schroeder, 1953). Little is known of spawning areas or activity but it is suspected that the eggs are pelagic, and the adults die after spawning

(Hardy, 1978). Eels reach coastal areas as elvers (65 to 90 mm long) approximately 1 year after hatching and in the interim have undergone two leptocephalus and two glass-eel stages.

SNAKE EEL FAMILY

Speckled Worm Eel

The speckled worm eel (Myrophis punctatus) occurs in offshore waters, inshore beach areas, tidal marshes, and oligohaline creeks from North Carolina to Brazil but is uncommon north of Florida (Wang and Kernehan, 1979). Information reviewed by Wang and Kernehan (1979) and Hardy (1978) indicates that the species is euryhaline, occurring in salinities from 17 to 37 ppt. Spawning occurs in offshore waters in fall and winter and leptocephalus larvae (48 to 80 mm long) and elvers (39 to 59 mm long) migrate inshore and utilize shallow waters of bays and inlets as nursery areas. Leptocephalus larvae were reported in salinity from 0.0 to 39.5 ppt. Elvers are initially planktonic, but cease their planktonic existence between March and May and burrow into mud or along grassy shores.

HERRING FAMILY

Atlantic Menhaden

Atlantic menhaden (Brevoortia tyrannus) is an abundant inhabitant of coastal and estuarine waters from Nova Scotia to Florida (Wang and Kernehan, 1979). Nicholson (1978) reported that the species consists of a single population that overwinters in offshore waters off the southeast coast of the United States, moves northward in spring, stratifies along the coast by age and size during summer, and moves southward in late autumn. Information reviewed by Young (1974) and Jones, et al., (1978) indicates that most spawning occurs in the South Atlantic from January to March and in the Middle Atlantic area from October to December and March to May in salinities usually greater than 25 ppt. Larvae are initially carried by ocean currents to coastal areas and once able to swim (ca. 5.0 to 28.7 mm long), they move to water of low salinity (fresh to 10 ppt) and metamorphose into juveniles (30 to 50 mm). Emigration back to the sea occurs after the first summer, as late as January in southern waters, although some late-spawned young of the season may overwinter in the estuaries.

Threadfin Shad

The threadfin shad (Dorosoma petenense) occurs in the Gulf of Mexico drainage and has been introduced to various disjunct localities throughout the United States (Jones, et al., 1978). Data reviewed by Jones, et al., (1978) indicate adults are found in pelagic areas of bays, large rivers, reservoirs, lakes, and estuaries. Adults are apparently euryhaline as fish have been reported from salinities of 0 to 32.3 ppt. Spawning occurs in freshwater from April through July. Adhesive, demersal eggs are shed in open water or nearshore areas over beds of vegetation or other objects projecting from the bottom. Larvae (5.2 to 20 mm long) are found only in freshwater but juveniles (18 to 20 mm) may be found in brackish water. The juveniles prefer salinities below 15 ppt and are most common below 5 ppt.

ANCHOVY FAMILY

Bay Anchovy

The bay anchovy (Anchoa mitchilli) occurs in estuarine and coastal waters from Maine through the Gulf of Mexico and is one of the most abundant fishes from the mid-Atlantic region to the Gulf of Mexico (Wang and Kernehan, 1979). It is usually found in areas with muddy bottoms and brackish water, but the distribution is so general that the fish may be expected also in grassy areas and along sand beaches (Hildebrand, 1963). Hildebrand (1963) further reported that virtually every section of the coast within the range of the bay anchovy has a distinctive population, and that whatever migration does take place is an inshore offshore movement. A review of available information by Jones, et al. (1978) indicates that fish mature in about 2.5 months and that spawning in Biscayne Bay, Florida occurs all year, though it is uncommon in December and January. Apparently, eggs are broadcast in waters less than 20 m (65.6 ft) deep in harbors and estuaries, although possibly to the edges of the continental shelf. Dovel (1971) found that eggs in the Chesapeake Bay area were most abundant in waters with salinities of 13 to 15 ppt. Larvae (2.7 to 16 mm total length [T.L.]) predominate in surface waters and are very common in Biscayne Bay at salinities ranging from 30 to 35 ppt. Juveniles (>22.5 mm S.L.) ascend rivers and are found in both shallow and deeper waters. Dovel (1971) found the highest densities of juveniles in the Chesapeake Bay area at salinities of 3 to 7 ppt.

MINNOW AND CARP FAMILY

Golden Shiner

The golden shiner (Notemigonus crysoleucas) is indigenous to most waters east of the Rocky Mountains; along the Atlantic coastal plain it occurs from the maritime provinces to Florida (Wang and Kernehan (1979). Based on a review of available literature (Wang and Kernehan, 1979 and Jones, et al., 1978), golden shiners prefer clear waters of lakes, rivers, and streams with abundant vegetation. Although it is most abundant in fresh and oligohaline waters (less than 2.0 ppt), specimens have been collected at salinities up to 14.4 ppt. Spawning generally occurs from March through October, when adhesive eggs are typically shed over submerged vegetation in shallow waters. Centrarchid nests often serve as a spawning substrate. Juveniles (>18 mm T.L.) have been recorded from brackish water and tidal freshwater among aquatic plants over various types of bottom.

NEEDLEFISH FAMILY

Atlantic Needlefish

Atlantic needlefish (Strongylura marina) primarily inhabits inshore shallow waters from Maine to Florida and throughout the Gulf of Mexico (Dahlberg, 1975; Hardy, 1978). Based on reviews by Hardy (1978) and Wang and Kernehan (1978), it is more common in brackish and marine waters (salinity up to 36.9 ppt), but specimens have been collected in freshwater areas. Spawning occurs from April through June in Florida; locations include estuaries (salinity up to 18 ppt), inshore bays, and river mouths to freshwater locations. Demersal eggs containing attachment filaments are deposited in masses of algae in shallow waters. Larvae and juveniles generally are found in lower salinities than adults. Larvae (<48.2 mm T.L.) have been reported from freshwater feeder streams; juveniles from 125 to 245 mm long have been collected in lakes, rivers, bays, harbors, and along beaches.

KILLIFISH FAMILY

Rainwater Killifish

The rainwater killifish (Lucania parva) is a euryhaline species (salinity range 0.0 to 48.2 ppt) that occurs from Cape Cod to Mexico (Hardy, 1978). Adults school and utilize a wide range of habitats that include offshore marine waters, marshes, ditches, brackish pools, and lakes (Hardy, 1978). The spawning season is more or less continuous for populations in Florida, and more than one brood may be produced by a single female (Hardy, 1978). Spawning occurs near the surface; the adhesive eggs are shed over fine-leaved aquatic vegetation and masses of algae (Wang and Kernehan, 1979). Hardy (1978), based on a review of available information, indicated that the species migrates to fresher water to breed and returns to saltier water after breeding. McLane (1955) detected no no migratory movements from collections in the St. Johns River. Newly hatched larvae rest on the bottom and postlarvae swim just above the bottom (Hardy, 1978).

LIVEBEARER FAMILY

Mosquitofish

The mosquitofish (Gambusia affinis) originally occurred from southern New Jersey to Mexico and in the Mississippi drainage as far as central Illinois, but through worldwide introduction now has a wider range than any other freshwater fish (Hardy, 1978). Adults often congregate in large schools; they have been found in most aquatic habitats and in waters up to 29 ppt salinity (Hardy, 1978). Laboratory experiments performed by Casterlin and Reynolds (1977) to determine behavioral preferences indicated that the fish preferred calm water, dark-colored substrates, and subsurface vegetation; floating cover was avoided. According to information reviewed by Hardy (1978), mosquitofish mature from within 28 days to the second summer of life and spawning may occur anywhere within their environment. The spawning season extends throughout the year in Florida waters, with longer periods betweeen broods in winter. Copulation is accomplished through the modified anal fin of the male and eggs develop entirely within the ovaries. Brood frequency varies from 2 to 8 per reproductive season. Larvae swim immediately after birth and may seek refuge in shallow water, but typically remain near the place of birth for up to 1 week. At 2 to 3 weeks, juveniles venture into deeper water; at about 4 weeks they begin moving with adults.

SILVERSIDE FAMILY

Rough Silverside

The rough silverside (Membras martinica) is a resident of inshore waters from New York to Mexico but is most numerous in the southern part of its range (Wang and Kernehan, 1979). Information on habitat preference reviewed by Martin and Drewry (1978) indicates the silverside is commonly found in open shallow water along exposed shorelines with little vegetation. The salinity ranges from freshwater to about 37 ppt. Fish appear in upstream areas in summer and early fall, and evidence exists of an offshore movement with onset of lower temperatures. Other information reviewed by Martin and Drewry (1978) and Wang and Kernehan (1979) indicates that spawning occurs just outside the breaker zone on sandy beaches primarily in waters with salinities of 20 to 25 ppt. The spawning season appears to extend from late spring through most of the summer. Eggs are demersal and possess adhesive filaments for attaching to vegetation, debris, or each other. Egg clusters and debris are carried inshore to the intertidal zone in large clusters by wave action. Larvae and juveniles were collected from the Chesapeake Bay area in water of less than 15 ppt salinity (Dovel, 1971).

Tidewater Silverside

The tidewater silverside (*Menidia beryllina*) inhabits estuarine and inshore waters from Cape Cod to Mexico (Wang and Kernehan, 1979). It is most commonly found in waters of low salinity (<10.0 ppt) over sand or gravel substrate, especially in association with aquatic vegetation. Spawning occurs in waters of very low salinity (<5 ppt) during May through August and demersal adhesive eggs are broadcast over vegetation or other bottom debris (Martin and Drewry, 1978). Habitat for larvae, juveniles, and adults is essentially the same--vegetated shallows of waters ranging in salinity from 0 to 15 ppt and concentrated at 2 to 8 ppt (Martin and Drewry, 1978).

SUNFISH FAMILY

Bluegill

The bluegill (Lepomis macrochirus) occurs from southern Canada southward to northeastern Mexico and Florida. Typical adults weigh from 3 to 6 ounces; a fish weighing more than a pound is very uncommon. Bluegills abound in artifical impoundments, but are also common in the deeper pools and backwaters of streams and rivers. They live in clear warm water where aquatic plants are abundant. They have a strong tendency to school, and are often found in loose aggregations of 20 or 30 fish (Pflieger, 1975).

Bluegills reach sexual maturity at 1 to 3 years of age; females produce about 2,500 to 80,000 adhesive amber-colored eggs, with an average of 17,933 for Buckeye Lake in Ohio (Bell, 1973; Carlander, 1977; Scott and Crossman, 1973). Spawning occurs from late May to July at temperatures of 19°C to 27°C (67°F to 80°F), according to Calhoun (1966) and the Ohio Department of Natural Resources (no date). A nest is built in 0.3 or 0.6 m (1 or 2 feet) of water on almost any type of bottom, although gravel is preferred. Often many nests are located close together. The male guards the nest until the fry leave, usually several days after hatching. Growth is rapid; as the fish become larger, they move to deeper water (Pflieger, 1975; Scott and Crossman, 1973). Calhoun (1966) reported thermal preferences of 16°C to 27°C (60°F to 80°F) for bluegill.

Insects are the staple food, but these fish are known to eat a wide variety of foods, including zooplankton, small fish, fish eggs, snails, mollusks, mites, small crayfish, amphipods, and algae (Calhoun, 1966; Pflieger, 1975).

Bluegill are probably the most popular sport sunfish in North America. They may easily be caught with worms, crickets, and many other kinds of insects.

Largemouth Bass

The largemouth bass (Micropterus salmoides) ranges from southern Quebec to northeastern Mexico and from Minnesota to Florida. In addition, it has been widely introduced outside its natural range and habitat. Largemouth bass in Florida are considered to be a separate subspecies.

Adult largemouth bass are ordinarily 254 to 508 mm (10 to 20 inches) long and weigh 0.5 to 4 pounds. The largest representatives of this species, which come from lakes, may measure nearly 0.6 m (2 ft) and weigh close to 9 pounds (Trautman, 1957); Florida specimens may weigh considerably more.

Largemouth bass typically frequent the quiet backwaters of large low-gradient rivers and the weedy embayments, shallows, and marshes of lakes. They prefer warm, moderately clear water and abundant vegetation, and avoid flowing water. Acceptable bottom types range from soft muck and organic debris to firm gravel, sand, or hard clay (Pflieger, 1975; Trautman, 1957). In the daytime they are found in deep water around submerged objects; in the evening they move to the shallows to feed (Pflieger, 1975).

In Tennessee, largemouth bass spawn in their second year (Breder and Rosen, 1966). In Canada, however, males spawn when 3 to 4 years old, and females when 4 to 5 years old. A single female may carry as many as 100,000 eggs, averaging about 2,000 to 7,000 eggs per pound (Scott and Crossman, 1973). The spawning season begins about mid-April and extends to late May or June. Males may clear areas for nests in any silt-free area, although rocky or gravelly bottoms seem to be preferred. Sometimes the eggs are deposited on submerged vegetation with little apparent nest preparation in streams; favored spots are sloughs, oxbows, the deep quiet portions of pools, or other areas without currents (Pflieger, 1975). Water depth is usually about 0.3 to 1.2 m (1 to 4 ft) (Scott and Crossman, 1973). The water temperature averages about 21°C (70°F). The nests are often used later by other fish (Breder and Rosen, 1966).

The eggs are guarded by the male and hatch in 3 to 10 days. Fry begin to feed when 5 to 8 days old, but remain in a tight school over the nest until some 5 days later, when they begin to move about the nursery area. The male stays with the schools of tiny fish for several days after they leave the nest. These schools may include 4,000 to 5,000 young, and do not disperse until about a month after hatching (Breder and Rosen, 1966; Pflieger, 1975). The survival rate for young largemouth bass is extremely low; of these thousands of fry in a school only 5 or 10 may live to reach a length of 254 mm (10 inches) (Scott and Crossman, 1973).

At first the fry eat cladocerans (water fleas) and other small crustaceans. As they grow they begin to eat aquatic insects and larvae as well. The diet of the adult fish includes: fish (especially gizzard shad), crayfish, large insects, and occasionally such tidbits as frogs and mice (Pflieger, 1975).

The largemouth bass is one of the most important sport fish in the United States. A variety of natural baits and artificial lures can be used with success (Pflieger, 1975).

DRUM FAMILY

Spot

The spot (Leiostomus xanthurus) is common in inshore and estuarine waters from Massachusetts to Mexico (Wang and Kernehan, 1979). Information reviewed by Johnson (1978) and Wang and Kernehan (1979) indicates adults are euryhaline (taken in salinities from 0 to 60 ppt) and are commonly found over mud and sand bottoms in inside waters and offshore to at least 132 m (433.2 ft). Both Atlantic and Gulf Coast populations migrate offshore in fall to spawn and to escape low temperatures. Fish mature at the end of their second year or early in their third, and there are indications that the fish do not survive after spawning. Spawning in Florida waters occurs from December through March. Generally, spawning areas are well offshore in moderately deep water with possibly some activity near beaches. Larvae migrate inshore and enter estuarine nursery grounds as juveniles (20.8 to 50 mm) about 4 months after hatching. Although juveniles have been taken in salinities from 0 to 34.2 ppt, smaller individuals are taken generally in waters with salinity below 4.9 ppt.

Atlantic Croaker

The Atlantic croaker (Micropogon undulatus) frequents inshore waters from Massachusetts to Argentina and the Gulf of Mexico (Dahlberg, 1975). In a review of available literature, Johnson (1978) reported that adults are most abundant on mud-sand mixture substrates, particularly near mouths of tidal sounds and several miles offshore. The fish is most abundant at higher salinities, although it has been taken in salinities ranging from 0 to 70 ppt. General seasonal movements are up estuaries in spring and oceanward in fall. South of Cape Hatteras fish mature at about the first year, and spawning usually occurs offshore but may occur in larger estuaries. Spawning season lasts from September through possibly June for fish south of Cape Hatteras, with peak activity occurring around October or November. Larvae spend their first days at sea and move toward the estuaries. Juveniles (11 to 110 mm) are found in estuarine and coastal waters at moderate depths to shoal waters. Most move well up into tidal streams to areas of reduced salinity (0 to 21 ppt), and then move seaward as growth proceeds. Few remain in tidal rivers or sounds more than 1 year.

Juveniles taken in Chesapeake Bay during spring and summer were concentrated midway up the estuary at about 18 ppt salinity and were primarily confined to bottom waters of relatively deep channels. Although juveniles were taken in salinities from 0 to 36.7 ppt in Texas, they were most abundant below 15 ppt.

GOBY FAMILY

Darter Goby

The range of the darter goby (Gobionellus boleosoma) extends from Delaware Bay to Brazil (Dahlberg, 1979). Dahlberg (1979) reported their habitat to include high salinity tide pools and occasionally waters of beach and high marsh. Gunter (1945) reported their presence in shallow water over muddy bottoms in lower estuaries and sounds in waters with salinity ranges from 0.3 to 34 ppt. McLane (1955) reported collections from waters ranging in salinity from 13 to 18 ppt. Data reviewed by Fritzsche (1978) indicate that spawning occurs in high salinity areas from mid-March to April. Eggs are demersal and are attached to submerged objects by means of threads.

Naked Goby

The naked goby (Gobiosoma bosci) is an inshore species that inhabits oyster and clam beds, marshy pools, shallow vegetated waters, and beaches from Connecticut to Mexico (Wang and Kernehan, 1979). Although the species occurs over a salinity range of 0.04 to 45 ppt, a distinct preference is indicated for salinities under 22 ppt (Dawson, 1969). Spawning generally commences in May and continues into October. Eggs may be attached to the inside of gaping shells of dead oysters, clams, or other debris and are guarded by the male until they hatch (Dahlberg and Conyers, 1973). Larvae (10 to 15 mm long) generally are found upriver, or at least in water with salinities less than 18.5 ppt (Fritzsche, 1978).

Clown Goby

The clown or largemouth goby (Microgobius gulosus) is common on muddy estuarine substrates and in habitats protected by aquatic vegetation ranging from Chesapeake Bay to Corpus Christi, Texas (Fritzsche, 1978). McLane (1955) reported that the breeding season extends from March through August in the St. Johns River, Florida and that the species was collected in waters with salinities ranging from 0.089 to 8.8 ppt.

LEFTEYE FLOUNDER FAMILY

Bay Whiff

The bay whiff (Citharichthys spilopterus) occurs from New Jersey to Brazil including the Gulf of Mexico and the Caribbean (Dahlberg, 1975). Based upon a review of available information, Martin and Drewry (1978) indicated that the species is found in very shallow water on mud and frequently among mangroves. The species is apparently euryhaline but is reported to prefer higher salinities. No clear pattern of seasonal movements was discerned. McLane (1955) reported the species to occur in the main channel of the St. Johns River, in tidal tributaries, and over sandy and muddy bottoms in open waters. He collected the species at salinities ranging from 1 to 15 ppt.